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NORTH DAKOTA SOCIETY
OF ENGINEERS

PROCEEDINGS

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PROCEEDINGS

OF THE

NORTH DAKOTA SOCIETY OF ENGINEERS

(ORGANIZED IN 1909)

VOLUME FIVE
1921

TWELFTH AND THIRTEENTH ANNUAL MEETINGS

Edited by the Secretary, under direction of the Executive Board

The Society is not responsible for any statement made or opinion expressed by members in these papers.

Published by the Society, 1921
PRICE SEVENTY-FIVE CENTS

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OFFICERS

for the Society Year 1921

(Elected by the Society February 11, 1921)

Executive Board:

President, R. M. Stee, Valley City.

First Vice-President,, E. R. Griffin, Mandan.

Second Vice-President, W. B. Stevenson, Fargo.

(Appointed by the Executive Board)

Secretary-Treasurer, E. F. Chandler, University.

Librarian, W. H. Robinson, Bismarck.

MEMBERS OF THE SOCIETY

The numbers after each name are the annual conventions attended by that member; the date, time of admission to membership. Immediate notice of any errors or changes in address should be sent to the secretary.

Names marked † are those of members who have resigned since last publication of Proceedings.

ACTIVE MEMBERS

Date of membership

Anders, Frank L., 1205 Sixth St. S., Fargo.
City Engineer..2, 3, 5, 6, 8, 10; Charter

Babcock, Earle J., University..........................3, 4, 5, 8, 9, 12; Charter
Dean of Engineering, State University.

Baker, Walter A., Amenia..3 ,4, 5, 10; Charter
Civil Engineer.

Barnes, Paul M., Valley City.................................13; March 11, 1920
Engineer, Dakota Engineering and Construction Co.

Bartlett, L. M., Builders Exch. Bldg., Minneapolis, Minn.
Contracting Engineer, Power Plants........................6, Feb. 13, 1914

†(Becker, Albert J., University)......................3, 4, 5, 6, 8, 10; Charter
Professor of Applied Mathematics, State University.

Bergman, Oscar N., Valley City..................................11; Jan. 31, 1919
Superintendent Electric Light and Water Works.

Black, Walter G., Mandan......9,13; Jan. 31, 1917
Municipal Engineer (Black & Griffn).

Bliss, Jay W., Valley City......5, 6, 7, 8, 9, 11, 13; Feb. 14, 1913
Dakota Engineering and Construction Co.

Bradshaw, Frederick H., Valley City......11; Jan. 31, 1919
Dakota Engineering and Construction Co.

Brown, William H., Grand Forks......4, 8, 10, 12; Feb. 16, 1912
Manager, Red River Power Co.

Budge, William E., University......8, 12; Feb. 26, 1916
Assistant in Mining Research, School of Mines.

Burdick, Leroy W., Wahpeton......10, 12; April 18, 1914
City Engineer.

Burdsal, Charles S., 642 Metropolitan Bank Bldg., Minneapolis, Minn.
Field Engineer, Portland Cement Assn......11, 12; Jan. 31, 1919

Chandler, E. F., University....3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13; Charter
Professor of Civil Engineering, State University.

Clark, John H., Bowbells......6, 7, 9, 10; Feb. 13, 1914
County Surveyor.

†(Clipfell, Carroll D., Wyndmere)......3, 4; Charter
Vice-President and Manager, Wind Electric Corporation.

Crabbe, Samuel F., Fargo......2, 3, 4, 5, 6, 10, 11, 12; Charter
Consulting Engineer and Architect.

Craig, Harold K., Pierson Court, Bismarck......13; Jan. 31, 1919
Maintenance Engineer, State Highway Commission.

Dale, Lloyd B., Valley City......8, 10; Jan. 30, 1917
Dakota Engineering and Construction Co.

Dickinson, Thorne, Colhoun, Lowndes Co., Alabama......Feb. 5, 1915
With T. R. Atkinson.

Fox, Alfred C., Hackney Bldg., St. Paul, Minn......13; Feb. 24, 1916
Superintendent, General Utilities Corporation.

Frahm, A. R., 308 Eighth St. So., Fargo......6, 10; Feb. 13, 1914
Engineer, Union Light, Heat and Power Co.

Frahm, Herbert C., Minot......3, 4, 5, 6, 7, 8, 11, 13; Jan. 18, 1911
County Surveyor.

Geisler, Carlyle D., Bismarck......12; Jan. 31, 1919
Assistant Engineer, State Highway Commission.

Giles, Curtis S., Crookston, Minn......8, 12; Feb. 25, 1916

Griffin, E. Ray, Mandan..12, 13; Jan. 31, 1919
City Engineer and County Surveyor.

Grime, Edwin M., 1341 11th Ave. N., Fargo..10, 11, 13; Mch. 1, 1918
Supervisor of Bridges and Buildings, Northern Pacific Railway.

Hall, Walter H., 323 South Main St., Minot..........6, 7; Feb. 13, 1914
Surveyor.

Hansen, John M., State Engineer's Office, Bismarck.
Assistant State Engineer..9, 13; Jan. 31, 1919

Harrington, L. C., University..8; Feb. 24, 1916
Assistant Professor of Mining and Metallurgy, State University.

Heinmiller, George W., Carrington.............5, 6, 8, 10, 11, 12; Charter
City Engineer and County Surveyor.

Hibbard, Melville L., Fargo..4, 10; Feb. 16, 1912
Manager, Union Light, Heat and Power Co.

Hoar, Vernon A., Valley City..11, Jan. 31, 1919
Salesman, Northern Electric Co., of Minneapolis.

Horton, Gilbert R., Jamestown..............................11, 13; March 1, 1919
Architect.

†Hunt, Augustus, Crookston, Minn..............................7, 8; Feb. 5, 1915

Hurning, H. H., Jamestown..............................12, 13; March 11, 1920
City Engineer.

Ingram, Joseph A., Grand Forks....6, 7, 8, 9, 10, 12, 13; Feb. 13, 1914
County Surveyor.

Jack, Esther M., Williston..............................10, 11, 13; Feb. 21, 1918
City Engineer.

Jacobsen, R. T., Fargo..12; March 11, 1920
City Engineer.

Jardine, J. A., Fargo..............................2, 4, 6, 9, 10, 12, 13; Charter
Bridge Engineer and Contractor.

Jenkins, David R., University..12; March 1, 1919
Professor of Electrical Engineering, State University.

Jensen, Louis P., R. D. No. 1, Kenmare........................7; Feb. 16, 1912
Civil Engineer.

Kaulfuss, Julius E., Bismarck..............................11, 13; Jan. 31, 1919
Assistant Chief Engineer, State Highway Commission.

Keene, E. S., Agricultural College............2, 3, 6, 8, 10, 11, 13; Charter
Dean of Engineering, State Agricultural College.

LaDue, A. D., Carson........Feb. 21, 1918
County Surveyor.

Lewis, Paul K., Wahpeton........11, 12, 13; Jan. 31, 1919
Field Engineer, Portland Cement Association.

McCargar, D. K., Kansas City, Mo........March 13, 1920
Independent Electric Machinery Co.

McKeown, Ralph, Devils Lake........March 11, 1920
Engineer, State Highway Commission.

†(Mendelsohn, I. W., University)........12; March 11, 1920
Engineer, State Board of Health.

Miller, Arthur S., Bismarck........13; Feb. 11, 1921
Engineer, State Highway Commission.

Moyer, William W., Bismarck........13; Jan. 31, 1919
Engineer, State Highway Commission.

Porter, George W., Watertown, S. D........11, March 1, 1919
Manager, Watertown Tile and Construction Co.

Robinson, Harris, Washburn........9, 13; Jan. 30, 1917
Superintendent of Highways.

Robinson, William H., Bismarck........12, 13; Jan. 31, 1919
State Engineer and Chief Engineer of State Highway Commission.

Russell, Charles H., Box 111, Fargo........13; Feb. 11, 1921
Electrical Engineer, Westinghouse Sales Dept.

Schmidt, H. B., Epworth........3, 5, 6, 7; Jan. 18, 1911
Surveyor.

Schmidt, Karl C., Valley City........8, 9, 10, 11, 12; Feb. 25, 1916
City Engineer and County Surveyor.

Sheffield, Fred W., Fargo........6, 10, 13; Feb. 13, 1914
Engineer, Fargo Bridge and Iron Co.

Slocum, R. H., Agricultural College....2, 3, 4, 5, 6, 7, 8, 10, 11; Charter
Civil and Sanitary Engineer, Professor of Civil Engineering,
State Agricultural College.

Smith, W. Jay, Grand Forks........8, 12, 13; Feb. 24, 1916
Engineer with J. A. Ingram.

Solberg, Martin, Towner........9, 10, 13; Jan. 31, 1917
County Surveyor.

Spalding, Deane B., Box 386, Fargo........13; March 11, 1920
Engineer with S. F. Crabbe.

Stacy-Judd, Robert B., 231 Eighth Ave., Calgary, Alberta.
Architect..........7; March 1, 1919

Stee, Clarence O., Valley City..........13; Feb. 11, 1921
Mining Engineer.

Stee, Reuben, M., Valley City..........10, 11, 12, 13; Feb. 21, 1918
President Sheyenne Valley Light and Power Co.

Stevenson, W. Bonnell, Fargo..........7, 8, 10, 11, 12, 13; Feb. 13, 1914
County Surveyor.

Swendseid, Anthony, Petersburg..........12; March 11, 1920
County Surveyor.

Thomas, E. J., Minot..........1, 2, 4, 5, 6, 7, 10, 11, 12, 13; Charter
City Engineer.

†(Thompson, Clinton A., Galena, Ill.)..........8, 10; Feb. 25, 1916
Engineer, Northern States Power Co.

Ueland, Martin, Cooperstown..........5, Feb. 14, 1913
County Surveyor.

Veigel, W. R., Dickinson..........1, 5, 7, 9; Charter
County Surveyor.

Wallace, John A., Bismarck..........6, 8, 12, 13; Jan. 31, 1919
Assistant Engineer, State Highway Commission.

†(Ward, Walter G., Agricultural College)..........10; Feb. 8,, 1917
Assistant Professor of Architecture, State Agricultural College.

White, Edmund, Bottineau..........1, 2, 3, 6, 7, 8, 10, 11, 12; Charter
County Surveyor.

ASSOCIATE MEMBERS

O'Gorman, William, 615 North Fourth St., Grand Forks.
Machinery Salesman..........7, 9, 10; Feb. 24, 1916

JUNIOR MEMBERS

Batten, Peter Jay, Box 499, Minneapolis..........Feb. 5, 1915
Federal Vocational Training Board.

Flint, Howard R., Box 628, Pocatello, Idaho..........8; Feb. 5, 1915
Engineer, State Highway Commission.

Hulteng, Alf. F., 722 Belmont Ave., Grand Forks..8, 12; Mch. 1, 1918
Plumbing Contractor.

Michel, Gottlieb G., Donnybrook..........7, 11; Jan. 31, 1919
Surveyor and Farmer.

Monley, Gorie, Valier, Montana..........April 18, 1914
Irrigation Engineer.

Moultrie, G. Earle, University..........12; March 1, 1919
International Harvester Co.

Noble, Harold A., Valier, Montana..........12; Jan. 31, 1919
Irrigation Engineer.

Richards, Mansell, University..........12; March 1, 1919
Student at State University.

Sanders, A. L. R., 711 Eleventh St. S., Moorhead, Minn.
..........10; Feb. 22, 1918

Sprague, Vernon H., Pipestone, Minn..........8, 9; Feb. 5, 1915
City Manager.

Sussex, Frank H., Hope..........12; Jan. 31, 1919

Wardwell, Theodore M., Sheridan, Wyoming..........8; Jan. 30, 1917
Irrigation Engineer.

ASSOCIATES

Abbott, George A., University..........2, 4, 5; Charter
Professor of Chemistry.
Leonard, Arthur G., University..........4, 5, 6, 8, 12; Charter
Professor of Geology.

DECEASED MEMBERS

Blair, Elmo H., Grand Forks..........10; Feb. 22, 1918
Died October 24, 1918.

Hartstein, J. Leonard, Fargo..........10; Feb. 21, 1918
Died October, 1918.

Severance, Martin E., Minot..........Feb. 5, 1915
Died February 16, 1919.

Stevens, Robert P., Agricultural College..........2; Charter
Died September, 1913.

Stone, Fernando D., Knox..........2; Charter
Died March 24, 1913.

Wanner, Theodore L..........April 13, 1914
Died September 7, 1916.

ANNUAL CONVENTIONS

of the North Dakota Society of Engineers

First Convention, Bismarck, February 11, 1909.

Second Convention, Agricultural College, January 18 and 19, 1910.

Third Convention, Fargo, January 17 and 18, 1911.

Fourth Convention, Grand Forks, February 15 and 16, 1912.

Fifth Convention, Bismarck, February 13 and 14, 1913.

Sixth Convention, Fargo, February 12 and 13, 1914.

Seventh Convention, Minot, February 4 and 5, 1915.

Eighth Convention, Grand Forks, February 24 and 25, 1916.

Ninth Convention, Bismarck, January 30 and 31, 1917.

Tenth Convention, Fargo, February 21 and 22, 1918.

Eleventh Convention, Valley City, January 30 and 31, 1919.

Twelfth Convention, Grand Forks, March 10 and 11, 1920.

Thirteenth Convention, Bismarck, February 10 and 11, 1921.

Preliminary organization was effected at the first convention in 1909. The formal constitution was adopted at the second convention in 1910.

The Proceedings have been published in these years:

Volume One, including the first to sixth annual meetings, 182 pages.
Volume Two, seventh annual meeting, 51 pages.
Volume Three, eighth and ninth annual meetings, 114 pages.
Volume Four, tenth and eleventh annual meetings, 112 pages.
Volume Five, twelfth and thirteenth annual meetings.

Small bulletins and special circulars have also been issued from time to time, on occasion.

The Constitution was printed in Volume One, and again in Volume Four.

OFFICERS

of the North Dakota Society of Engineers
as elected at the meeting of each year for the ensuing Society year.

President:
1909—Thomas A. Haigh
1910—C. M. Baker
1911—S. F. Crabbe
1912—H. G. Lykken
1913—W. A. Baker
1914—T. R. Atkinson
1915—F. L. Anders
1916—J. W. Bliss
1917—J. A. Ingram
1918—E. J. Thomas
1919—J. A. Jardine
1920—E. M. Jack
1921—R. M. Stee

Vice-Presidents:
1910—Ed White
J. A. Jardine
1911—J. C. Field
T. R. Atkinson
1912—T. R. Atkinson
S. F. Crabbe
1913—E. J. Thomas
W. R. Veigel
1914—H. C. Frahm
F. L. Anders
1915—J. W. Bliss
J. A. Ingram
1916—J. A. Ingram
H. C. Frahm
1917—R. H. Slocum
J. H. Clark
1918—G. W. Heinmiller
W. R. Veigel
1919—E. M. Jack
R. M. Stee
1920—R. M. Stee
E. R. Griffin
1921—E. R. Griffin
W. B. Stevenson

Sec't'y-Treasurer:
1909-1911—R. W. Livingston
1912-1921—E. F. Chandler

TWELFTH ANNUAL CONVENTION

Grand Forks, North Dakota, March 10-11, 1920

The Twelfth Annual Convention of the Society was called to order by the secretary (in the absence of the president and vice-president) at the City Hall, Grand Forks, at 10:15 a. m., March 10, 1920.

S. F. Crabbe was elected chairman pro tem.

The secretary, E. F. Chandler, made report on the business of the society for the past year.

An address of welcome was delivered by Mayor H. M. Wheeler, and response on behalf of the society was made by chairman S. F. Crabbe.

The report of the treasurer, E. F. Chandler, was read and referred to auditing committee.

The chairman was by vote requested to appoint committees on Auditing, Nominations, and Resolutions, and appointed the following:

Auditing Committee: G. W. Heinmiller, R. T. Jacobsen.

Nominations Committee: E. J. Thomas, W. H. Brown, F. L. Anders.

Resolutions Committee: C. S. Giles, E. R. Griffin, W. H. Robinson.

Report of the special committee on Possible Affiliation with the American Association of Engineers was made by Chairman E. J. Thomas and discussed by S. F. Crabbe, W. B. Stevenson, C. S. Giles, E. F. Chandler, Ed White, C. S. Thompson and E. J. Thomas.

A report on the New Water and Sewer System Regulations of the State Board of Health was presented by I. W. Mendelsohn, and discussed by W. B. Stevenson, C. S. Giles, E. R. Griffin, S. F. Crabbe, W. H. Brown, E. F. Chandler, I. W. Mendelsohn and others.

Adjourned, 12 noon. Total number present at the session, 35, of whom 22 were members.

Called to order at 2 p. m. by Chairman S. F. Crabbe at City Hall.

Report presented by D. R. Jenkins on the Proposed National Department of Public Works, and discussed by E. F. Chandler, S. F. Crabbe, E. J. Babcock, L. P. Dove, D. R. Jenkins and others.

Report on Municipal Improvements presented by C. S. Giles.

An address on the North Dakota Good Roads Association and Highway Bonds was given by Geo. C. Reeder of Michigan City, N. D., secretary of that association.

A report by J. E. Kaulfuss on the Traffic on North Dakota Highways was read by J. A. Wallace.

W. E. Hart, division engineer of the Portland Cement Association, whose district office is at the Metropolitan Bank Building, Minneapolis, gave a talk on Hard Surfaced Highways.

Adjourned 4:15 p. m. Attendance at this session 50, of whom 27 were members.

A Good Roads Banquet for the Grand Forks Commercial Club and the North Dakota Society of Engineers was held at the Commercial Club at 6:15 p. m. There were 80 present, of whom about 26 were members of the society.

Chairman R. B. Griffith of the Good Roads Committee of the club presided.

Addresses were made by J. R. Pourpore, chairman of the Grand Forks County Commissioners, by W. H. Robinson, chief engineer of the State Highway Commission, by E. O. Hathaway, Minneapolis district engineer of the Bureau of Good Roads, U. S. Department of Agriculture, and by George C. Reeder, secretary of the North Dakota Good Roads Association, and brief remarks by Mayor H. M. Wheeler and Dean E. J. Babcock.

Adjourned 8:15 p. m.

Called to order at City Hall, 10 a. m., March 11, by President J. A. Jardine.

Paper on Sanitary Work in Epidemics read by Dr. Samuel Claman, Health Officer of Grand Forks.

Applications for admission to membership were presented, and were voted on by ballot. Each of the following eight applicants was elected an active member by unanimous vote, 20 members voting.

P. M. Barnes, Valley City.
T. C. Hockridge, Hunter.
H. H. Hurning, Jamestown.
R. T. Jacobsen, Fargo.
R. McKeown, Devils Lake.
I. W. Mendelsohn, University.
D. B. Spalding, Fargo.
Anthony Swendseid, Petersburg.

On the Nominations Committee, in place of F. L. Anders, absent, President Jardine appointed S. F. Crabbe.

A paper by L. O. Marden on the Bismarck-Mandan Missouri River Bridge was read by W. H. Robinson.

Treadwell Twitchell of Mapleton, N. D., delivered an address on Highways and Highway Construction in North Dakota, which was discussed by W. B. Stevenson and others.

Adjourned at 12:00 noon. Present at this session 55, of whom 28 were members.

Called to order at 1:45 p. m. at City Hall by President J. A. Jardine.

A paper on Irrigation in North Dakota was read by E. F. Chandler.

A paper on the Increased Cost of Material Used by Public Utility Companies was read by C. A. Thompson.

A report on Fees and Per Diem for Engineering Services was given by S. F. Crabbe.

A brief report on Legislation was made by K. C .Schmidt.

Affiliation with the American Association of Engineers was taken up for final consideration.

A resolution authorizing immediate amalgamation of the N. D. S. E. with the A. A. E. and providing for the appointment of a committee to arrange the details, embody them in a new constitution and by-laws for the society, and submit the new constitution to the members of the society for final approval by letter ballot, was offered by Committee Chairman E. J. Thomas and discussed by E. F. Chandler, E. J. Babcock, S. F. Crabbe, C. S. Giles, K. C. Schmidt, Ed White, E. J. Thomas and others.

A ten minute recess was taken to allow the committtee time to modify the resolution.

The society was again called to order, and the following resolution adopted by unanimous vote:

"Whereas: We believe that the engineering and public works functions of the Government, now scattered through several departments, bureaus and commissions, should be brought together under a single control and operated by specialists,

Be It Resolved: That the North Dakota Society of Engineers hereby expresses itself in favor of the general idea of the "Jones-Reavis bill" in so far as it pertains to the engineering and public works functions, but prefers to leave the Bureau of Education as already provided for in the "Smith-Towner bill" creating a separate department.

And Be It Further Resolved: That copies of this resolution be sent to our Senators and Representatives in Congress."

The following resolution was adopted by unanimous vote:

"Whereas: The North Dakota State Board of Health has promulgated Rules and Regulations for the preparation and submission of Plans for Water Supply and Water Treatment Systems and Sewerage Systems and Sewage Treatment Works, and

"Whereas: It has developed, in the consideration of the said Rules and Regulations by the engineers of this State Society of Engineers, that certain sections might work expensive hardships upon the municipalities in connection with the preliminary steps in placing water and sewerage systems and extensions and the approval of the same by the State Board of Health, therefore,

Be It Resolved: That a committee of three members of this society be appointed by the president to confer with the State Board of Health with a view to reaching a complete and practical understanding of the said Rules and Regulations and the rewriting of the same if necessary, so that the engineer in designing these works in the several portions of the state which present a variety of local conditions, will know exactly the requirements of the Board of Health in all cases."

G. W. Heinmiller, chairman of the Auditing Committee, reported the complete audit and approval of the accounts of the treasurer of the society.

E. J. Thomas, chairman of the committee on nominations, reported recommending the following as officers of the society for the coming year:

President—Esther M. Jack, Williston.

Vice-Presidents—R. M. Stee, Valley City, and E. Ray Griffin, Mandan.

This report was adopted and the officers elected by unanimous vote of the society.

Invitations for the Thirteenth Annual Convention of the society were received from four cities, Minot, Jamestown, Bismarck and Fargo. The invitation from Minot was presented by letters from the City Commission and the Association of Commerce; that from Jamestown by letter from the Chamber of Commerce; that from Bismarck verbally by W. H. Robinson; that from Fargo verbally by S. F. Crabbe.

After discussion it was ordered that a vote by ballot be taken. Twenty-two votes were cast, of which Minot received 7, Jamestown 8, Bismarck 4 and Fargo 3. On a second ballot, Minot received 6, Jamestown 15, and Bismarck 1. Therefore Jamestown was declared the next place for meeting.

The committee on Affiliation with A. A. E. presented resolution for that purpose which stated as the sense of the session that amalgamation with the A. A. E. would be beneficial to the members of the N. D. S. E. and to the society and provided for the appointment of a committee to arrange details for such affiliation, embody them in a revision of the constitution of the society, and submit the whole matter of affiliation and revision of the constitution with the arguments for and against to the members of the society for a letter-ballot. And that if the amalgamation shall receive a three-fourths vote on the letter-ballot, it shall become thereby official.

After discussion, the following substitute for this resolution was passed by a vote of 11 to 9. Voted: That we recommend that any and all members of this society who wish to join the American Association of Engineers do so individually, but that this society keep its organization intact.

After further discussion, the committee on Possible Affiliation with the A. A. E., (E. J. Thomas, chairman, R. H. Slocum, H. C. Frahm, K. C. Schmidt, G. W. Heinmiller) was by vote reappointed, requested to ascertain definitely the details of possible affiliation, to arrange the whole in suitable form for final action, and to report same for final vote at the next annual convention after having presented it to all the members for several weeks advance consideration if practicable by means of mimeographed letter, or other arrangement.

The following resolution was unanimously adopted:

"Be It Resolved by the North Dakota Society of Engineers that we extend a vote of thanks to the Local Committee, the Commercial Club, and the citizens of Grand Forks for their very cordial reception and for our entertainment during this convention."

W. E. Hart of the Portland Cement Association talked to the society on Present Difficulties in Securing Transportation for Materials.

Adjourned at 5:00 p. m. Number present at this session 50, of whom 27 were members.

Total different members present at the sessions of the two days, 33.

E. F. Chandler,
Secretary.

MINUTES OF EXECUTIVE BOARD

The Executive Board for the coming year met at the City Hall, Grand Forks, at 5:00 p. m., March 11, 1920. R. M. Stee and E. R. Griffin were present, constituting a quorum. J. A. Jardine of the former board was also present and sat with them.

The Executive Board formally appointed E. F. Chandler as Secretary-Treasurer for the coming year and W. H. Robinson as Librarian.

The Board appointed H. H .Hurning and G. R. Horton as Committee on Local Arrangements and Program.

Mr. Hurning was invited to sit with the Board. It was informally agreed that, except the special committees already appointed during the session and this Committee on Local Arrangements and Program, no other committees should be appointed unless need becomes evident later, and that the chairman of the local committee shall be authorized to draft (either directly or thru the Executive Board or Secretary) at any time any members of the society for any desired subjects or features for the next program.

It was informally agreed to set the time for the next convention at about the middle of January, 1921.

E. F. Chandler,
Secretary.

CHANGE OF PLACE FOR 1921 CONVENTION

In response to an invitation from J. E. Kaulfuss, President of the North Dakota Chapter of the American Association of Engineers, in behalf of that organization which had its second annual convention scheduled for Bismarck, Febuary 10 and 11, 1921, that the North Dakota Society of Engineers should hold its annual convention jointly with them at that time, a circular letter was sent out by the Secretary, November 22, 1920, to all the local members, with postal card ballot enclosed for vote on whether to hold the next meeting at Jamestown or Bismarck.

The membership list of the society (deducting formal resignations) was then 93, although the addresses of eight were unknown, and six others were permanently so far distant that no ballot was sent. By December 1, 1920, answers had been received from 47, which is a majority of 93. Of these, 42 voted for Bismarck, 5 for Jamestown, and circular announement of the change to Bismarck accordingly was sent out December 1. Subsequently votes were received from six more, all for Bismarck. Total, Bismarck 48, Jamestown 5.

THIRTEENTH ANNUAL CONVENTION

At Bismarck, North Dakota, February 10 and 11, 1921

(In Joint Convention with North Dakota Chapter of American Association of Engineers)

The first joint session was called to order at 10:40 a. m., February 10, 1921, at the Community Room of the Public Library, Bismarck, North Dakota, by J. E. Kaulfuss, President of the North Dakota Chapter of the American Association of Engineers.

After some introductory remarks by Mr. J. E. Kaulfuss, explaining the purpose and the spirit of this joint session, Mr. C. L. Young, president of the Bismarck Commercial Club, gave an address of welcome. Response was made in behalf of the A. A. E. by George Ludvigsen, and in behalf of the N. D. S. E. by Miss E. M. Jack.

By nomination from the floor and unanimous approval of the joint session, the following joint Committee on Resolutions was appointed:

E. J. Thomas, J. W. Bliss, W. G. Black, Harris Robinson, E. M. Jack, J. S. Ingram, J. N. Roherty.

Adjourned 11:15 a. m.

Total number present at session 56, of whom about 24 were members of the N. D. S. E.

Executive Committee of N. D. S. E. (E. M. Jack, R. M. Stee, and E. R. Griffin) met at 11:20 a. m., and appointed the following committees:

Committee on Nominations: H. C. Frahm, chairman; P. K. Lewis, W. J. Smith.

Auditing Committee: W. B. Stevenson, P. M. Barnes.

The second joint session was called to order at 1:55 p. m. at the Public Library by E. M. Jack, president of the North Dakota Society of Engineers.

Report on Pending Legislation was made by E. J. Thomas, and discussed by E. W. Robinson, J. E. Kaulfuss, J. N. Roherty, W. B. Stevenson, E. F. Chandler, R. M. Stee, H. A. Hard and others.

A paper on Rate Regulation and Regulation Engineering was read by E. H. Morris, chief engineer of the North Dakota Railroad Commission and discussed by J. N. Roherty, E. W. Robinson, and others.

A report on Municipal Improvements this year and the Future Outlook was made by E. R. Griffin, and discussed by E. J. Thomas and others.

A paper on the Rules of the State Board of Health was read by J. N. Roherty of the city engineer's office, Bismarck, and discussed by W. G. Black, J. E. Kaulfuss and others.

Adjourned, 4:00 p. m.

Present at this session 54, of whom about 24 were members of the N. D. S. E.

Third joint session called to order at 7:40 p. m. at the Public Library, by W. G. Black, Mandan, first vice-president of the North Dakota Chapter of the American Association of Engineers.

A paper was read by E. M. Grime on a National Department of Public Works. After some discussion it was voted to instruct the Resolutions Committee to submit the next day a suitable resolution on this subject.

C. O. Stee, superintendent of mining department for the Cerro de Pasco Copper Corporation, gave a talk before the session on Mining in South America, which aroused many inquiries and further discussion from those present.

W. H. Robinson read a paper on the Work of the State Highway Commission.

Adjourned at 8:50 p. m.

Present at this session 50, of whom about 25 were members of the N. D. S. E.

After adjournment, those present attended the entertainment at the Rex Theatre, at which the out-of-town delegates were the guests of the Bismarck Club of the American Association of Engineers.

The fourth joint session was called to order at the Public Library at 9:50 a. m., February 11, by R. M. Stee, first vice-president of the N. D. S. E.

A paper on Forestry in North Dakota was read by F. E. Cobb, Superintendent of the Government Experiment Station at Mandan, and was discussed by those present.

A detailed description of the construction of the Missouri Bridge at Bismarck was given by C. W. Cubbage, superintendent for the Foundation Company, and was discussed by many members.

A report on Flood Control in North Dakota was made by E. S. Keene, president of the State Flood Control Commission, and discussed by O. E. Blanding of Harvey (president of the North Dakota Flood Control Association) and H. A. Hard.

By unanimous vote the session expressed appreciation and thanks to the Barrett Company of Minneapolis, the Portland Cement Association of Minneapolis, and the Rabbet Contractor's Equipment Company of St. Louis for engineering films furnished for use at this convention and for other courtesies, and instructed the secretary to convey their thanks by letter.

Adjourned at 12:00 noon.

Present at this session 63, of whom about 26 were members of the N. D. S. E.

At 1:00 p. m. by the courtesy of local members and the Commercial Club and Town Criers, all the visitors were taken by automobile for an hour to the Missouri River Bridge now under construction; thence, passing the Bismarck Country Club, to the Penitentiary, and guided through the Penitentiary; thence past the Government auto trucks stored at Fort Lincoln for the future use of the State Highway Commission.

On return to the Public Library, a business session of the North Dakota Society of Engineers was called to order at 4:10 p. m. by E. M. Jack, president. Present, 24 members, and also about 30 members of the A. A. E., who were invited to take part in the discussions when desired.

The following applicants were admitted by unanimous vote as active members:

Arthur S. Miller, 422 Fifth St., Bismarck, N. Dak.

Charles H. Russell, Box 111, Fargo, N. Dak.

Clarence O. Stee, Valley City, N. Dak.

A summarized statement or report of the business of the previous annual convention (at Grand Forks, February, 1920) was presented by the secretary-treasurer, E. F. Chandler.

The treasurer's report was read, and statement that the books had been audited and found correct was made by W. B. Stevenson, chairman of the Auditing Committee.

E. J. Thomas, chairman of the Resolutions Committee, read a series of resolutions which had been proposed to the committee and revised or combined into a complete report submitted with the committee's recommendation. After further detailed discussion by those present and some minor amendments, they were passed by unanimous vote of all present, and are as fully stated in the attached appendix. For convenience in discussion and vote, they were separated into six groups, and a separate vote taken on each, these groups being:

(a) Miscellaneous Federal Matters.

(b) A Federal Public Works Department.

(c) Miscellaneous State Matters.

(d) The Whitman Concurrent Legislative Resolution on Highways.

(e) The Rules of the State Board of Health.

(f) Votes of Thanks.

H. C. Frahm, chairman of the Committee on Nominations, reported the following nominations for officers of the N. D. S. E. for the coming year:

President, R. M. Stee.

Vice-Presidents, E. R. Griffin, W. B. Stevenson.

The report was accepted, and these officers were elected by unanimous vote.

The subject of future policy of the society and relations with the A. A. E. was brought up for discussion and remarks were made by G. R. Horton, W. B. Stevenson, E. F. Chandler, E. J. Thomas, J. W. Bliss and others. Finally, as a report from the Executive Committee which had already been considering this question and obtaining by inquiry from the members through the past two days such concensus of opinion as was practicable, E. R. Griffin offered as a recommendation that the North Dakota Society continue under present conditions to preserve its organization intact and distinct from that of the American Association of Engineers, but that it hold joint meetings with the A. A. E. as often as practicable without involving its membership in unfairly long journeys; that is to say, that sometimes the annual conventions should be arranged as joint meetings.

On motion, this recommendation was unanimously adopted.

It was voted to hold the next annual convention at Jamestown.

It was voted to appropriate from the treasury of the society $25 for an Honorary Life Membership in the name of the society in the North Dakota Good Roads Association.

On invitation, Herbert Metzger, office manager of the North Dakota Good Roads Association, addressed the session briefly.

E. M. Jack, president of the society, thanked the society for the honor which had been extended to her.

Final adjournment was at 5:45 p. m.

Total number of members of N. D. S. E. at same session, 32.

At 8:30 p. m., the members of the N. D. S. E. and the A. A. E. with a few visitors, numbering about 70 total, had the annual banquet at the Annex Cafe. J. E. Kaulfuss was toastmaster, and the speakers included E. F. Chandler, F. W. Boetel, J. A. Ingram, J. A. Wallace, and Governor Lynn J. Frazier.

After the banquet, an Engineer's Dance was held in Patterson Hall, at which the visiting members were the guests of the Bismarck Club of the American Association of Engineers.

Saturday, February 12, at 10:30 a. m., a series of excellent engineering and road-building films were exhibited to the members at the Rex Theatre.

E. F. CHANDLER,
Secretary.

MINUTES OF EXECUTIVE COMMITTEE

The newly elected Executive Committee, R. M. Stee, E. R. Griffin and W. B. Stevenson, met at 5:50 p. m., February 11, and transacted the following business:

As secretary-treasurer for the coming year they appointed E. F. Chandler, without compensation, but with a reasonable allowance for necessary clerical help.

They requested the State Engineer, W. H. Robinson, to act as Librarian for the society, in accordance with standing custom.

A tentative date for the next annual convention at Jamestown, Wednesday and Thursday, before the annual meeting of the A. A. E., was selected.

As Arrangements and Program Committee for the next annual convention, H. H. Hurning of Jamestown was appointed chairman, with G. R .Horton and any other Jamestown members also on the committtee.

It was decided to continue the work long previously planned by the society of collecting facts for a state directory of Municipal Improvements, and to appoint R. M. Stee as chairman of a committee for that purpose. In accordance with former standing vote, the expenditures for necessary postage and clerical help already incurred by the committee (amounting to $22.23) were approved, and the publication of the summarized results in the forthcoming Proceedings of the Society ordered, with about 200 separates also to be issued.

E. F. CHANDLER,

Secretary.

SUMMARY OF ACCOUNTS OF TREASURER

January 28, 1919, to March 8, 1920.

Balance in treasury from previous year	$103.20
Collected from members during year:	
Delinquent dues	73.00
Initiation fees	42.00
Dues for current year	96.00
Dues in advance, for 1920 or later	8.00
Received interest on balance in treasury through year	4.86
Total	$327.06
Expended for:	
Expenses of Valley City convention	$ 14.00
Clerical help	31.25
Printing of proceedings, circular letters, programs, letterheads, application blanks, and envelopes	224.05
Postage on proceedings, programs, etc.	23.27
Total Expenditure	$292.57
March 8, 1920, balance in treasury at close of year	$ 34.49

March 8, 1920, to February 7, 1921

Balance in treasury from previous year		$ 34.49
Dues collected, delinquent	$30.00	
Dues collected for year 1919	49.00	
Dues collected for year 1920	30.00	
Total dues collected		109.00
Initiation fees collected		14.00
Interest on balance in treasury		4.16
Total		$161.65
Expended for:		
Clerical help	$26.50	
Stationery and printing	24.00	
Postage	11.00	
Miscellaneous items	3.45	
Total Expenditures		64.95
Balance in treasury February 7, 1921		$ 96.70

E. F. Chandler,

Treasurer.

PAPERS AND DISCUSSIONS

The following pages include such detailed report as it is practicable to furnish of the papers and reports and discussions on them, and the business discussions, at the Twelfth and Thirteenth Annual Conventions, 1920 and 1921. Some of the papers are printed in full, and others are somewhat condensed. Brief summaries are given of most of the talks, the manuscripts of which were not turned in by the authors. In this condensation there may have resulted serious omissions or misrepresentation so that in some details the intention of the speaker is not correctly conveyed; if so, the reporter begs that the members will pardon any such deficiency in the results of his efforts, but hopes that his summarized report will carry to the members not present at the meetings a general idea of the subjects considered by the society as deserving of attention.

SESSIONS OF MARCH 10 AND 11, 1920

HIGHWAYS AND BRIDGES

By Geo. C. Reeder

Secretary North Dakota Good Roads Association

(Summary)

We are about to launch a campaign in this state for new roads. In the first place we much conceive that the people of the country want them. There is now a countrywide desire for betterment of our highways, and about three-quarters of a billion dollars has recently been appropriated for this purpose by the different states. The magnitude of the services involved in such construction work is incomprehensible. It is beyond the capacity of the transportation plants to provide supplies. No two sets of people have the same idea as to how we can get these roads, and it is up to the engineers and the State Highway Commission and the Good Roads Associations to sway public opinion.

At present there is a wide divergence between government, state, county and local plans as to how our highways program should be put across, and by education we must unite the people of the country to work together. Our trouble is that very few land owners feel enthusiastic over the program unless the first road goes by their places. In Nelson County, out of $53,000 levied, only $3,000 was spent for roads; the rest was doubtless used to make up deficits in other departments.

The need of unification is evident when I tell you that construction is now being done by 53 separate divisions of our government. The many undue criticisms of the State Highway Commission from persons who are not educated as engineers are stumbling blocks in the way of progress. The State Highway Commission is the only way we can expect to have good roads. The criticisms that $2,600 per mile is too high to pay for roads, constructed by the State Highway Commission, is absurd. The State Highway Commission roads will last while many roads which have cost over $2,600 per mile are not even excuses for good roads.

The Grain Dealers in their recent convention discussed for half a day methods to cut down the transportation costs from the farm to the elevator. This cost is no small item.

We must strive to get the maximum amount of federal aid and to do this we must increase our own State Highway Department or the plans cannot be prepared fast enough.

The law which allows a man to work out his road tax was abolished 140 years ago in France, yet we still have it in North Dakota. Such laws as this, which only waste public money, must be changed.

At the present time this state faces a very critical situation, for unless the State Highway Commission gets immediate financial support, we stand to lose about two million dollars of federal aid. At the present time the appropriations for the work of the State Highway Commission are very inadequate and plans for federal aid projects cannot be worked up fast enough to take care of the money placed at our disposal by the government.

The Good Roads Association will circulate petitions (20,000 signers needed) to vote on an amendment to the State Constitution which will allow the state to issue bonds and make a loan for highway work. The state is already bonded very heavily and taxes are very high, but automobiles are only taxed half as much as they used to be. If this tax were increased to what it used to be we would have funds to take up the bonds and carry on the work. Then if a certain amount of the tax were laid aside each year, the bonds could be retired within 30 years, our roads built and the two million dollars federal aid saved.

The main trunk lines can be built by the State Highway Commission and the secondary lines built by the separate counties, providing our present laws are changed.

FEDERAL AID HIGHWAY PROJECTS

By E. O. Hathaway

District Engineer, Bureau of Public Roads, Department of Agriculture

(Summary)

There are three stages in federal aid projects:

1. Project statement stage, in which the surveys are made and plans drawn up.

2. The construction stage, which begins as soon as the project is approved. The fund then becomes "tied up," and cannot be lost to the state.

3. The maintenance stage, which begins when the highway goes into commission.

Before any project is approved, the government must be satisfied that it is "substantial." First, the highway must be in the proper location. Unless it connects two points which need to be connected, in the best and most economical manner, it is not substantial. To be substantial the highway must be direct. In this country we are accustomed to roads along the section lines. If, instead of following the section lines, we could cut across taking the hypotenuse, mathematically a great saving can be shown. In this country the blockading of highways by snow is a serious problem and the location should be made so that this will not have to be contended with. The location should also be made so as to accommodate the largest number of people along its path. In the matter of drainage I will say nothing, for less talk and more action is what we must have.

It has been shown that a car which will go 16 miles to the gallon (of gasoline) on a 0% grade, will only go 6.3 miles per gallon on a 6% grade, and 3.9 miles per gallon on a 12% grade. From this data we can figure what it costs to keep the steeper grades and whether or not they should be cut down. The question of safety on steep grades also enters as they are liable to wash or become slippery in rain storms.

The objection has been made that we require expensive roads. We believe that cheap roads should be built by other methods than by federal aid.

The following table shows the average cost per mile of earth and gravel roads in the four states over which I have jurisdiction.

STATE	EARTH	GRAVEL
Wisconsin	$5,074	$7,221
South Dakota	4,077	6,987
North Dakota	2,544	4,300
Minnesota	3,830	5,490

A road is an economical necessity. It should serve and we should look at it from a business viewpoint. Roads may be reduced in cost by first shortening the mileage, by building only one-half the width or by omitting or putting on an inferior surface. We feel that the kind of surface is not as essential as is good grading and drainage.

THE HIGHWAY SITUATION IN NORTH DAKOTA

BY W. H. ROBINSON

For many years those of our people who have been in a position to do so have learned that we are considerably behind most of the countries of Europe in the matter of highway building. The first few years of the recent war brought it to the attention of a still greater number, as it was largely by means of motor trucks and a system of highways that Germany was able to hurl her armies against one of the fronts and in an incredibly short time hurl them against another one that was considered by military experts to be far beyond danger of attack from any considerable concentration of forces within so short a period. Later during our own experience in the same war this great need, not only as a means of defense but as an economic asset as well, has been more forcibly emphasized.

In accordance with the awakinging to our great shortcomings in this respect, Congress in 1916 passed the first federal aid act. This act carried an appropriation of $75,000,000 to be distributed between the states during a period of five years to encourage the building of highways according to some approved system. The distribution was made on the basis of population, area and post route mileage. Under this distribution, North Dakota's percentage was 1.53, or a sum of approximately $1,242,000. This measure proved so popular that during February, 1919, Congress passed another measure carrying an additional appropriation of $200,000,000; $50,000,000 to be available immediately, $75,000,000 to be available for the fiscal year of 1920, and $75,000,000 for the fiscal year of 1921, thus giving North Dakota a grand total of $4,222,980.

In order to receive this aid, each state must have a Highway Commission to furnish plans and specification that will meet the approval of the Bureau of Public Roads, which is one of the divisions of the Department of Agriculture, which has direct charge of the admisistration of the federal aid act. In addition to furnishing plans, the federal aid funds must be matched by at least an equal amount. These funds are available only for a limited time, and if plans and specifications are not prepared and approved and the necessary funds provided to match them, they revert to the general fund and are pro-rated among other states that are in a position to take advantage of them.

This federal aid act has given such an impetus to road building that most states have provided great sums of money both by bond issues and direct taxation and are prepared to build a superior type of highways on a very large scale. According to the latest reports, the following neighboring states are among those with large sums available for 1920 construction under the supervision of their highway departments:

Nebraska has nearly $4,000,000; South Dakota has $5,000,000; Montana has $5,500,000; Michigan has $8,000,000; Minnesota has $18,000,000; Wisconsin has $18,000,000 for construction and $2,000,000 for maintenance; Kansas has $30,000,000; Iowa has $33,000,000, and Illinois has $35,000,000.

This aggregates over one hundred fifty millions for nine states.

When we come to consider the conditions existing within our own state it seems that the federal aid act has not yet succeeded in creating a demand for roads sufficient even to insure that all of its share of federal aid will be used within its borders. A majority of the counties of the state have agreed to furnish sufficient funds to match the federal aid, dollar for dollar, but it is feared than an insufficient budget will prevent the State Highway Commission from furnishing the engineering force necessary to provide the plans for the type of road that is now being constructed. This phase of the matter will probably require a little further explanation.

Previous to the last appropriation of Congress, North Dakota's share of federal aid to the end of the present biennium period was about $765,000, which when matched by an equal amount provided for a construction program of at least $1,530,000. Last winter a budget of $100,000 was requested from the state legislature to provide the necessary administration, engineering, equipment, etc., for the biennium period. Although there was at that time pending in Congress legislation that would give the state an additional $1,291,000 in federal aid for that period and the North Dakota legislature itself was wiring concurrent resolutions praying Congress to act favorably on that legislation, this appropriation was cut $10,000. It was hoped that the special session would provide the necessary relief. But alas, our hopes were short-lived, as this body saw fit to make an additional cut of $8,000 per year in the appropriation.

Since the counties had agreed to match the federal aid, dollar for dollar, it may be difficult to understand the attitude of the legislators toward this matter, especially since each dollar lacking for engineering means a loss of from four to eight dollars in federal aid to the state. In passing it might be well to call attention to the fact that this apparently indifferent attitude is not chargeable to any particular faction of the legislature, as the bill providing for the $8,000 reduction of the budget at the recent session had only one dissenting vote in the house. It seems to me, however, that this condition is brought about by the lack of any organization boosting for highway improvement according to some definite approved system. This has been entirely lacking in the state, while there has been some opposition by those who do not understand the proposition or have other motives for doing so.

The question may arise in the minds of some as to why the Highway Commission did not put this matter before the legislators. This was done at every possible opportunity, but there were so many other things to come before the short session that were considered of more importance that it was difficult to secure a proper hearing. The surest way of getting any attention in the matter is to have some organization in the district of each legislator bring this to their individual attention, for we have found in the past that one or two knockers in the home district could offset all the figures and arguments we can bring forth on the subject. Therefore it seems that an appropriate proverb to the occasion would be "an ounce of home boosting is worth a ton of Bismarck lobbying."

Let us now review what has been accomplished with the funds available to the Highway Commission for administration and engineering. Up to date a little more than one thousand miles of road have been surveyed. Contracts have been let for 510 miles of state highway at an average cost of $2,680 per mile, including 10% for contingencies and construction engineering. The cost of this 510 miles aggregates about $1,410,000. Two hundred ten miles of this was under construction in 1918 and an equivalent of 110 miles was completed. During 1919 contracts for 290 additional miles were let and an equivalent of 220 miles was completed. This leaves approximately 180 miles to be completed this season. This 510 miles involves about $670,000 of federal aid, leaving a balance of about $556,000 to be covered by project agreement before June 30, 1920. This would mean that we would have to have plans completed and approved for approximately 330 additional miles of dirt roads costing approximately $3,300 per mile. At present we have about 190 miles of these plans completed which are distributed among thirty-three different projects. If the Missouri River Bridge Project can be placed under project agreement before July first, it now appears that we will be able to prevent any loss of federal aid for the period that closes the last of next June.

When we begin to consider the task for the following year we are confronted with a very great problem. For the fiscal year ending June 30, 1921, we must have under project agreement sufficient highway to take care of $1,460,000 federal aid. This means that this amount of federal aid must be matched at least dollar for dollar and that we have to furnish surveys and plans for nearly $3,000,000 worth of work during the year if all the federal aid is to be saved to the state. If this is to be expended entirely on dirt roads, it will mean that about 875 miles of road will have to be surveyed and planned before July 1921. Of course this will be entirely out of the question as we should require a budget of about twice the present one for this alone. Besides the budget for this work, we would require additional funds sufficient to supervise the construction that would be under way at the same time. There seems to be only one possible way to take advantage of the state's entire share under the present circumstances and that is the adoption of a higher type of construction.

Those who are familiar with highway engineering under the federal aid requirements know that it requires practically the same amount of engineering for an ordinary dirt road as is required on the higher types. As the complete cost of a graveled surface road usually costs about twice that of a dirt road and the cost of engineering is practically the same, it is obvious that if the state were building gravel surfaced roads instead of ordinary dirt roads, the task of the State Highway Department would be reduced about one half, and 440 miles would probably take up our share of federal aid for next year. If a hard surfaced type of road were adopted, the number of miles necessary to take up the year's allotment of federal aid would be very much lessened and our engineering cost would be reduced in a proportion almost as great. The percentage of engineering cost on the total cost of a hard surfaced road occasionally does not amount to two per cent, while on dirt roads the average cost of engineering and administration on the work completed has amounted to nearly fourteen per cent. Since the federal government in most cases pays one half of the construction engineering, the cost to the state on dirt roads probably averages about eleven and one half per cent. We now have the explanation of why an expenditure of one dollar for engineering by the state will secure from four to eight dollars in federal aid. This of course is true only when we consider that the counties have agreed to match the federal aid dollar for dollar. Balancing the entire expenditure of the state and the county against that furnished by the federal government, we have the ratio of about 62:52 for dirt roads. For gravel roads the proportion would be about 56:51, and as the higher type of roads are adopted, the proportion will approach a 50-50 proposition.

Unfortunately, a limited fund for engineering is not the only handicap placed upon the Highway Commission. This budget also specifies the salaries that must be paid to its engineers. These salaries range in some cases as much as $1,500 per year below the average paid in eleven neighboring states for the corresponding position. This condition makes a kind of training school out of the department, since a considerable number of employees remain only long enough to receive experience sufficient to warrant other states taking them on at a higher salary. With the immense amount of highway construction going on in nearly all states the engineering situation is likely to become very acute everywhere, and North Dakota is apt to suffer even more in the future, as most of the other states are not going to quibble about salaries of engineers when their services are absolutely necessary to retain their allotment of federal aid.

Taken all together, the highway situation in North Dakota is far from what it should be and it now seems almost certain that a considerable portion of the state's share of federal aid will be forfeited to improve the highways of other states. As has been heretofore stated, there seems to be only one possibility of avoiding this loss, and this is by the building of some kind of surfaced roads that will greatly reduce the miles necessary to take up the federal aid available. The state now has available a great fleet of trucks, which when fitted with proper dumping equipment and used in connection with suitable loading machinery, can be used very economically in the gravelling of roads where gravel can be obtained within reasonable hauling distance. The selection of the type of road is pretty much up to the county officials, but they too have to cater to the wishes of the taxpayers in their particular counties, and since every section of the county is anxious to secure its share of road building, it is undoubtedly difficult for county commissioners to adopt a superior type of road with the necessary decrease of mileage.

THE STATE HIGHWAY SYSTEM OF NORTH DAKOTA

By J. E. Kaulfuss

There are in North Dakota approimately 70,000 miles of public highway—all in a more or less improved condition—generally less. Seventy thousand miles of public highway is equivalent practically to one mile of road for each square mile of area. The population of North Dakota is estimated at various figures, but it is believed that the recent census will show a population not greater than 750,000 or about 10 persons to the square mile of area or to the one mile of public highway on the average. With this ratio of population to area or road mileage, it is at once evident that the road problem in North Dakota has been and will be a serious one until the population is very much increased.

Seventy thousand miles of public highway is about 3% or one 1/30 of the entire mileage of roads in the United States. It is nearly equal to three times the circumference of the earth. In area the public highways of the state comprise some 560,000 acres or 875 square miles of 21½ townships or over one-half the size of the average county. In area this mileage is equal to Sargent or Renville Counties, larger than either Eddy, Foster, Griggs, Ransom, Oliver, Steele or Traill, equal to one-half of Cass, or one-third of McKenzie. The public highways constitute about 1/90 of the state's entire area, are equal to 1,700 average farms in North Dakota, and would provide a strip east and west across the state 2¼ miles wide, or a strip north and south nearly 5 miles wide.

At $25 per acre, the right of ways in our public highways are worth $14,000,000. If sown to wheat with a resultant crop of 13 bushels to the acre, the total crop would be worth $16,380,000.

North Dakota ranks no less than eighth in the states of the Union as to the number of automobiles per capita. With over 80,000 autos registered in 1919, there appears to be one car for about every nine inhabitants. The value of these cars is not less than $40,000,000. The cost of operating these cars is not less than $10,000,000 annually. Assuming that the average car travels 3,000 miles annually, the number of miles travelled by automobiles is 200,000,000 miles.

The total annual tonnage hauled on North Dakota roads is 5,000,000 tons, which with an average haul of six miles produces a traffic of 30,000,000 ton miles. The cost per ton mile in the state is not less than 30 cents, which gives the cost of hauling $9,000,000 annually. A saving of one cent per ton mile (the average cost per ton mile for the United States being 23 cents) would produce a saving of $300,000 annually to the state.

The annual combined township and county bridge and road levies is now about $3,000,000. While North Dakota possesses about 1/30 of the mileage in the entire United States, it expends but 1/100 of the total spent each year for roads and bridges in the country. Three million dollars a year on 70,000 miles results in a magnificent annual road and bridge fund for construction and maintenance of $43 per mile.

During the past 10 years there have been expended by towns and counties on roads and bridges no less than $25,000,000. That this vast sum has under the past system of road and bridge improvement given the state adequate results can not be asserted, much less proven.

The presentation of the foregoing figures is given only because figures of that nature are interesting and because such data present the road problem to us in a much different light.

It is not the purpose of this paper to enter into a discussion of the merits of the township or county system of building highways—at least not before a body of engineers who know—(pardoning the reference to our own profession)—that this money can not be sure of being expended efficiently and wisely without engineering direction, planning and supervision, without centralization of authority, without elimination of poliitcs and without systemizing the work.

The State Highway Department came into being just three years ago almost to the day. According to the federal aid road act, federal aid cannot be secured by any state except through its State Highway Department. Nor can it be secured except for the improvement of the state highway system.

The state law also provides that state aid can be expended only on main travelled roads, etc., which means on the state highway system.

The law further provides that the State Highway Commission shall prepare a map showing the main (or state) highways of the state which in the judgment of the several boards of county commissioners and the State Highway Commission are of sufficient importance to be designated *state roads.* In practice the several county boards indicate to the highway commission the roads in their respective counties deemed important enough to be called state highways. The State Highway Commission then makes the final selection and decision as to the roads to be included in the State Highway System.

The State Highway System as laid out by the State Highway Commission consists of about 5,000 miles of road, or 7% or 1/14 of the total mileage of public highways in the state. The state does not interest itself in the other 65,000 miles. This fact is significant in that it is evident that the establishment of the State Highway Department does not appreciably minimize the road and bridge building authority of the county or township officers. In fact with a higher type of improvement being built into the state roads, the county and township officials will find their constituents providing more and more road and bridge money and expecting a higher grade of road improvement. The existence of the state highway department does not solve all of our road problems. The township and the county roads will always be with us. Nor is the existence of the State Highway Department the last word in road improvement. A national highway commission with corresponding powers, authority and functions will be the next step necessary to round out the road building and maintaining program of the nation.

The 5,000 miles of road in the State Highways System naturally include the principal roads of the state. The system of state highways passes through 100% of the counties, through 100% of the county seats, through 88% of the incorporated cities and through 61% of the incorporated villages, which contain 83% of the total urban population. In addition to the foregoing service to the cities and villages, it is noted that 49% of the *total* population of the state lives within *three* miles of the system, 68% within *six* miles, and 85% within *twelve* miles. It is therefore evident that this small portion (5,000 miles out of 70,000 miles) of the public highways in the state, accommodates a very great percentage of its inhabitants.

The state Highway Department has submitted project statements to the federal government for about 1,300 miles of federal aid projects, being *fourth* among all the states of the Union in this regard. This 1,300 miles is equivalent to a road four times east and west across the state.

The State Highway Department has made surveys to the amount of 1,100 miles, or equivalent to one continuous road from Grand Forks to Buford, Grand Forks to Pembina, Grand Forks to Fairmount, and Grand Forks to Beach via Fargo. About 700 miles of road has been designed. Five hundred miles have been placed under contract—equivalent to one continuous road from Grand Forks to Beach and Buford. Only about 330 miles have been entirely completed—a stretch from Grand Forks to Beach.

Though these figures may be relatively gratifying, on further analysis it develops that, if it takes the state three years to construct 300 miles of road, it will take—at that rate—50 years to construct the entire state highway system. That there is a splendid opportunity for engineering and contracting in the highway field in North Dakota goes without saying, and will have been taken care of in other papers.

The purpose of this paper was to throw a new light on the problem confronting the state through its State Highway Department. The road program must be accelerated. To do that requires greater appropriations, not only to go into the work directly but also to furnish an adequate staff of efficient engineers.

As previously stated, the establishment and operation of a state highway department does not solve the road problems in the state. At most, the other governmental units, the cities, the villages, the townships and the counties must all harmonize their road and bridge work. Systematic and correlative improvement must take place. A well-conceived plan of general road improvement must be put into force whereby each road in the state will be improved at such a time and to such an extent as its relative importance justifies.

After all, the keynote in successful and satisfying road improvement is summed up in these three instructions:

1. Eliminate politics.
2. Systematize work.
3. Centralize authority.

STATE HIGHWAY MAINTENANCE

By H. K. Craig

INTRODUCTORY—IMPORTANCE OF MAINTENANCE

Highway maintenance is not merely important. It is vitally essential.

No matter how well constructed or of what advanced type of construction, any road improvement that after completion is not adequately maintained soon begins to deteriorate, and if deterioration is not checked it becomes unserviceable. The investment in the improvement is lost.

In very early times, with cheap labor (slaves) and restricted mileage, roads could be built of massive construction. Traffic was comparatively light, of two classes, horse drawn vehicles of light weight, and foot traffic, and the construction could be of such durable nature, as for example the Roman roads with heavy stone slabs on deep, carefully built and unyielding foundation, that the wear of traffic and exposure to the elements caused very little damage. In present times, with high priced labor and expanded mileage, construction is necessarily of a light character.

Most of our roads must carry on their native material widely varying classes of traffic, light and heavy vehicles, horse drawn, rapid traveling automobiles and heavy tractors and motor trucks. In some cases the native material can be protected by a cover of gravel. At best a comparatively light hard surface can be provided, whether block or bitumen on concrete, or concrete alone. All modern road improvement is necesarily designed with a careful regard to economy of both labor and material.

In order that any road improvement be defensible, interest on first cost plus maintenance plus depreciation must not exceed the value of the benefits to be secured to traffic, or benefit to property which is a measure of the benefit to traffic. Economy of first cost makes it impossible to eliminate depreciation and it is therefore left to maintenance to arrest depreciation so as to secure a maximum of benefit from the investment in the improvement. An approximate balancing of interest on first cost plus maintenance plus depreciation against benefit to traffic in this state clearly shows that under present conditions, except for a few miles of road radiating from the larger cities, the highest type of road improvement practicable is gravel surfacing. Therefore this discussion of maintenance will be confined to the maintenance of earth and gravel roads.

PROBLEMS OF MAINTENANCE

The principal purposes in highway improvement have been to provide a roadway with a hard, smooth surface, of sufficient width to accommodate traffic, and of good tractive quality, so that with a minimum amount of energy and with a minimum of vibration and shock, a given load can be transported safely and expeditiously over a given distance.

Rain, snow, traffic and wind all tend to damage or destroy road improvement. The rain, falling on the roadway on fills, causes erosion of the side slopes reducing the effective width of roadway. Falling on grades, particularly on grades in excess of four per cent, the runoff tends to scour the roadway, destroying the symmetry of section and smoothness of surface, and to carry off light gravel or selected material which may have been placed. Where there is an excess of clay or gumbo, the falling rain also makes the surface slippery or soft and sticky, according to the depth of penetration. Where there is a pervious surface and an unstable foundation, the rain soaking down lessens the bearing power of the foundation. The ability of the rain to soak through the surface and reduce the bearing value of the material beneath is of course increased when the uniformity of the surface is broken by ruts or by chuck holes or depressions.. The water that runs along the side of the road or that which collects and crosses under the road, also tends to soak into and soften the road's foundation.

Accumulation of snow on the road makes the use of the road difficult, or makes it impossible to wheel traffic, and moreover in thawing it permits the resultant water to penetrate average material to a considerable depth and to affect the foundation so that the surface, even after it has dried out, fails under the normal loads it was designed to carry.

Traffic has two marked destructive influences on earth and gravel roads. At times when the surface is wet, wheel loads tend to cut the surface. In the case of earth roads, wheel loads tend to cut deeply, destroying the road section and increasing the opportunity for water to penetrate. In the case of gravel, or selected material surfaced roads, wheel loads tend to cut through the surfacing, destroying the imperviousness of the surface and mixing up into the surfacing material the undesirable soil of the foundation. At times when the surface is dry, the abrasive action of wheels grinds the material of the surface to dust that blows away. The dust itself becomes a nuisance. Ruts appear, and if the material of the surface is not homogeneous, chuck holes appear.

The damage by normal traffic is principally due to the tracking of vehicles. If the roadway can be kept hard and smooth from shoulder to shoulder, travel will spread itself more or less over the entire width and will cause an even wear of the surface without ruts or chuck holes; and if the road can be kept free from ruts and chuck holes, the crown of the road should shed rain so that if the road has been properly constructed, that is, if sufficient fills have been made, and if the surface is not permitted to accumulate on the roadway, the foundation will remain dry and firm. Herein are suggested the problems of maintenance

THE AIM OF MAINTENANCE

The aim of maintenance has been, and is, to keep the surface of the roadway smooth and hard, to retain the effective width of surface and to retain or improve the tractive quality of the surface. It will also be the aim of maintenance to prevent or remove excessive accumulation of snow on the roadway.

MAINTENANCE OPERATIONS

In general, maintenance may be classified under four headings: 1, surface; 2, drainage; 3, roadside; 4, snow.

SURFACE

Under the heading "Surface" first comes the material maintenance. That is, in the case of gravel or selected material surfaced roads, the wear on the road should be made good. Small holes and ruts should be filled in as they appear so as to keep the wear on the surface even and an even resurfacing coat of gravel or selected material should be added from time to time as the surface coat wears down to dangerous thinness. In the case of earth roads, chuck holes and ruts should be filled in with sound material. In the case of earth roads, progressive maintenance further demands treatment of such sections as show poor tractive quality of surface. Sandy stretches of road should receive topping of clay or gumbo, and vice versa. Next under care of surface comes the maintenance of the section. This commonly is effected by frequent use of the drag with periodical use of blade grader.

DRAINAGE

Care of drainage is not less essential than care of surface, though simpler in operation. It is merely required to keep side ditches and culverts open. Side ditches are generally cleaned with a horse-drawn special drag. Culverts are necessarily kept open with hand shovel work. Under this heading also comes care of bridges and culverts, repair of bridge floors, painting of steel bridges and repair of endwalls.

ROADSIDE

The principal item under care of roadside is the cutting of weeds. These should be cut at least twice each year, one cutting in the spring and one cutting in the fall just before snow is expected. Other items are trimming side slopes and filling out shoulders when there has been erosion; cutting out brush, branches or trees that obstruct view and make curves dangerous, and repair and painting of guard rails.

SNOW

There is some doubt as to whether drifting snow can be successfully combatted, but it is the aim of maintenance to prevent cuts blocking with snow by the use of snow fences where necessary, and it is intended to attempt to remove from the roadway such excessive quantity of snow as would obstruct wheel travel through the winter and cause serious weakening of road surface or foundation in thawing.

LAWS

By act of the Legislative Assembly the special road maintenance fund of each county—that is, the funds from the auto license fees that are returned to the county—is set aside for paying the costs of maintaining the designated state highways in the county under the supervision of the State Highway Commission. By act of Congress the Secretary of the United States Department of Agriculture is authorized to issue regulations. He charges the state with responsibility for the proper maintenance of each federal aid project completed in the state under penalty of being deprived of all further federal aid.

PROCEDURE IN 1919

In the spring of 1919 effort was made to place the State Highways under maintenance under the State Highway Commission's supervision. Sections of five or six miles length each were assigned to the care of patrolmen with team, under contract, at specified rate of pay per hour or per mile for each operation as dragging with three horses, dragging with four horses, dragging with light tractor, patrolman working alone, patrolman with team, under contract, at specified rate of pay per hour In nineteen counties a total of 539 miles was put under contract in this way, the Maintenance Department of the State Highway Commission being charged with responsibility for supervision of the work and certification of work performed, and the County Auditor with authority from the County Commissioners as prescribed by law, paying for the work, upon certification, from the county's special road maintenance fund. In almost every case the patrolman was a farmer, and unfortunately the critical time for maintenance work on the road, as for instance just after a light rain, often happened to be a time when there was important work to be done on the farm, and the farmer felt himself obliged to look after his farm work to the neglect of his road maintenance work. Results were not good. Comparatively few of the sections were properly maintained.

This system was patterned after systems that had worked to very good advantage in some other states; but in this state, perhaps on account of the much shorter growing season, it was shown that farmers cannot be depended upon to work the road, particularly to drag the road, at the proper time. It was also shown that unskilled labor in this state is not qualified to work on road maintenance without fairly close supervision.

PROCEDURE FOR 1920

Since the State Highway Commission cannot afford to handle accounts and furnish close supervision of the work of the thousand patrolmen, who, with teams, would be required to maintain the entire State Highway System, it has been necessary to limit for 1920 state supervision of maintenance to completed federal and state aid projects except in the cases of counties that request state supervision and agree to pay the cost thereof.

In the present plans for maintenance, dependence is placed on motor trucks.

At the close of hostilities of the late World War, the Federal

Government was in possession of vast stores collected for purposes of warfare and for such purposes no longer useful. In disposing of this material a considerable part that was determined to be serviceable for road construction, is being turned over to the Secretary of Agriculture, who, under authority conferred by Congress, is distributing it among the states in the proportion determined for the federal aid act.

Conditions attached to the distribution of the material are that:

1. The state shall pay freight and handling charges.

2. That the material shall be used only for the construction, repair and maintenance of roads built wholly or in part with federal aid, that is, on the State Highway System, in counties that are doing federal aid work, and

3. That the title to the material may not pass from the State Highway Commission while the material is in serviceable condition.

About one-third of the material set apart for distribution has already been delivered under the above conditions. With respect to the material remaining to be distributed, Congress has under consideration a bill that would amend the above conditions so that the states would each pay 20% of the appraised market value of material to be received, in place of freight and handling charges.

The most valuable of the material being distributed consists of a large number of motor trucks of various make and capacity. North Dakota's total allotment of motor trucks is estimated at 321. Unfortunately, the State Highway Commission has not sufficient available funds to pay the charges on the trucks, and has no funds available for operation. It is therefore necessary to make such arrangements with the counties as will allow the trucks to be received and placed in operation at the counties' expense. It is proposed that the counties pay actual operation costs, driver, fuel, oil, repairs, etc., and in addition pay to the State Highway Commission a rental of four dollars per day for each day use of each truck, a part of which fee shall reimburse the fund from which freight and handling charges were paid, another part of which shall be set aside toward paying the cost of equipping the motor trucks with automatic hoist dump body (the trucks as received not being equipped with bodies suitable for handling road materials); another part of which shall be used to provide a fund from which to pay costs of supervision; and the balance of which shall constitute a "depreciation and extraordinary repair fund."

MOTOR TRUCK OPERATION—MAINTENANCE

It is proposed to assign one motor truck to each approximate twenty miles under maintenance. It is proposed that in each county—or perhaps in each County Commissioner's district—a contract be awarded for cutting weeds, with team and mower, and that all other maintenance work be performed by or with motor trucks. Having a section of about twenty miles of road to care for, each truck can make the round trip with drag in a day. It is intended to equip each of these trucks with a drag that will cover not less than one-half of the width of the road between shoulders. Dragging, it is estimated, will require an average of twenty days of each truck's time. Other maintenance, surface repair, care of drainage and care of roadside, will probably require an additional twenty-five days of each truck's time.

Using the trucks in this way, having comparatively long sections and so comparatively few working units, having these working units always available at short notice for critical maintenance or emergency repair, and having sufficient funds for supervision, it is believed that with this system an organization and a degree of efficiency can be developed that will solve the maintenance problem, which after all is not so much a problem of method as of promptitude and thoroughness of execution.

MOTOR TRUCK OPERATION—SURFACING

It would of course be difficult to develop economy and efficiency in an organization that functioned only forty-five days in a year, and so it has been planned to arrange so that—when not occupied with maintenance—the trucks will busy themselves surfacing roads that have been surfaced with federal and state aid. In this way federal aid may be secured to reimburse the county in such amount that the total net cost of truck operation will be comparatively light. The program will furnish efficient maintenance at reasonable cost and in addition will furnish, each year, a considerable mileage of gravel or selected material surfacing with very little increased expenditure of county funds.

The State Highway Commission is endeavoring to make the necessary arrangements with the counties to place the trucks in operation on this maintenance-surfacing plan and satisfactory progress is being made.

STATE HIGHWAY BRIDGE CONSTRUCTION IN NORTH DAKOTA

By L. O. Marden, *Bridge Engineer*

SYNOPSIS

Bridge engineering and building has been recognized as a specialty for more than thirty years and consequently has become more highly developed than some other branches of engineering. The disastrous bridge failures and short life of bridges, resulting from the design and construction of bridges by any kind of an engineer or surveyor, is finally bringing the public to the realization that the standardization of bridge design is eliminating the construction and use of these badly designed structures.

I. STANDARDIZATION OF BRIDGE DESIGN

For all bridge construction outside of the corporate limits of cities, the State Highway Commission is the logical organization that should handle the standardization of bridges that will be constructed on county roads. The Highway Commission has only been in existence three years, but during that time has made long strides toward this goal. The use of standard specifications, of no engine loading but that of a 20-ton traction engine, and design of structures by one organization, gives the farmer who is moving his threshing outfit, or the owner of a fleet of heavy auto trucks, the assurance that he can pass over any designated state road constructed as a state or federal aid project and having standard Highway Commission bridges thereon, without stopping to examine the old type of bridge (which may be shaky), without a silent prayer, or trust to luck that his outfit may pass over the structure without landing in the bottom of the creek. The public also has the assurance that important details are not missing or cut down, as they have been by unscrupulous bridge companies when these companies submitted competitive designs of structures to the county commissioners at a bridge letting, and when the county commissioners, having not had the wherewithal to employ a competent engineer, have been forced to take the cheapest bid as being satisfactory of design and let the bid on that basis. Circumstances have proven more than once that the cheapest bridge is not always the cheapest in the end, for this type of bridge has a short life and has to be renewed in a very few years. The inspection of the commission's standard structures by Highway Commission engineers eliminates the chances of giving a dishonest contractor opportunity to "skin the structure." The Highway Commission at the present time has issued one set of reinforced concrete box culverts, openings 1½x1½ sq. ft. to 6x6 sq. ft.; std. R. C. abutments for slab and tee beam structures, heights 8′-25′-0″ inclusive; std. R. C. abutments for R. C. girder spans, height 8′-20′ inclusive; std. girder spans 30′-0″ to 50′-0″ inclusive; tee beam girder spans 20′-0″ and 30′-0″ spans; std. river piers, etc.

II. THE STATE LAW AS TO BRIDGES

A. *State Engineer.* The State Engineer has the following duties in regard to bridges under the paragraph headed *Chief Engineer*—Salary, Duties. Section 4, Chapter 131, Session Laws, 1917.

"He shall collect information and statistics with reference to * * * the character and conditions of the * * * bridges of the different counties of the state * * *. He shall, subject to the approval of the State Highway Commission, determine the character and have general supervision of the construction, improvement, repair and maintenance of all * * * bridges constructed or improved under this act, and shall prepare or cause to be prepared all plans and specifications therefor and shall report all proceedings of his office relating to public highways (bridges) to the State Highway Commission whenever required. He shall consult with and call for information from the county officials having authority over highways and bridges relative to any action affecting said bridges, and it shall be the duty of the county commissioners to supply or require the proper county officer to supply, all information that they are able to give relative to * * * bridges within their respective counties."

Bridges Defined; Apportioning Cost of Construction and Maintenance. Section 7, Chapter 131, Session Laws of 1917, ,as re-enacted and amended by paragraph 3, section 11 of S. B. 97, Session Laws of 1919.

"For the purposes of this act the necessary bridges on any highway shall be considered a part of such highway. But the contract for bridges may be let separately. The cost of all work of construction or improvement of bridges and highways under the provisions of this act shall be paid, fifty per cent by the state and fifty per cent by the county in which the work of improvement is located." (Chapter 131, Section 7, Session Laws of 1917.)

Commission Meeting—Time and Place, Duties. Section 2, H. B. 170, Session Laws, 1919, amending and re-enacting Section 2 of Chapter 131, Session Laws of North Dakota for 1917.

The State Highway Commission shall meet at the capitol and other convenient places and at such times as it may deem essential to the carrying out of the provisions of this act. It shall determine the character and have general control and supervision of the construction, re-construction, improvement, repair and maintenance of all state highways, hereinafter defined, including all bridges, culverts, and other highway structures therein as are improved, constructed or reconstructed under the provisions of this act, and shall direct and supervise the maintenance of the entire system of state highways. It shall determine the character and have general control and supervision of the construction and re-construction of all bridges, culverts and other highway structures and of all other improvements on the system of state highways. For the purposes of this act the necessary bridges and culverts on any such highway shall be considered a part of such highway, but contracts for bridges and culverts may be let separately. From and after the passage and approval of this act, no portion or portions of any state highway shall be vacated or changed except upon the approval and consent of the State Highway Commission.

FEDERAL AND STATE AID

Assent to Federal Aid Act and Pledge of Co-Operation. Section 3, H. B. 170, Session Laws of 1919, amending and re-enacting Section 8 of Chapter 131 of Session Laws of North Dakota for 1917.

The legislative assent required by section 1 of the act of Congress approved July 11, 1916 (Public No. 156) entitled "An Act to provide that the United States shall aid the states in the construction of rural post roads and for other purposes," is hereby given. The State Highway Commission is authorized and empowered to make all contracts and do all things necessary to co-operate with the United States Government in the construction of roads under the provisions of the said act or any other act of Congress that may hereafter be enacted.

Under these laws the State Highway Commission has designed the following concrete bridges, most of which have been completed or are under construction:

On F. A. P.*No. 3, in Williams County, two bridges of two 40′ spans each, and one 12′ single span bridge.
On F. A. P. No. 12, in Barnes County, one 20′ single span bridge.
On F. A. P. No. 13, in Stutsman County, one 40′ single span bridge.
On F. A. P. No. 14, in Stark County, one 16′ single span bridge.
On F. A. P. No. 16, in Grand Forks County, one 30′ single span bridge.
On F. A. P. No. 23, in LaMoure County, one 16′ single span bridge.
On F. A. P. No. 29, in Steele County, one 50′ single span bridge.
On F. A. P. No. 32, in Cass County, one 50′ single span bridge, and one bridge, consisting of three 40′ spans.
On F. A. P. No. 39, in Grant County, one 16′ single span bridge.
On F. A. P. No. 44, in Bottineau County, one 40′ single span bridge.
On F. A. P. No. 56, in Stutsman County, one bridge consisting of two 50′ spans.
On F. A. P. No. 64, in Logan County, one 26′ single span bridge.
On F. A. P. No. 65, in Stark County, one 30′ single span bridge.
On F. A. P. No. 87, in Bottineau County, one 50′ single span bridge, and
On F. A. P. No. 105, in Hettinger County, one bridge consisting of three 50′ spans.

In addition to these is the proposed Missouri River Bridge between Bismarck and Mandan which is known as Federal Aid Project No. 100. A more detailed description of this bridge follows.

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* F. A. P.—Federal Aid Project.

MISSOURI RIVER BRIDGE

A. IMPORTANCE

The imperative necessity of a wagon bridge over the Missouri River within the state of North Dakota must be patent to every citizen of the state. For nearly half a century the seventeen counties of the so-called Slope Country have been as actually segregated from the rest of the state as though they were surrounded by a Chinese wall. The result has been that the Slope Country has been neglected, undervalued and politically ostracized. The construction of the Bismarck-Mandan bridge is the most important project of state-wide interest in the history of North Dakota. The fifty-three counties of the state are now one, and the rapid development of the Slope Country is absolutely assured.

B. LOCATION

The bridge is located about a mile below the present Northern Pacific Railway Bridge at Bismarck. Three center spans were selected as the Northern Pacific bridge has the same number. As the piers of the two bridges will be practically in line, navigation will not be obstructed, and ice broken up by the N. P. bridge piers will tend to pass under the highway bridge without forming an ice gorge across the channel. The width of the Missouri River at the site selected varies from about 1,380 feet at low water to about 1,600 feet at average high water. The character of soil and the topography indicate that the total length of bridge between shore piers should be about 1,400 to 1,500 feet. The location on the west bank of the river secures the protection from ice and flood of the N. P. bridge, dyke and embankment. The elevation of the low point of steel as set by the United States War Department to provide for navigation is 36′-0″ above mean high water. The location of the east bank is a clay bluff, hard enough to successfully withstand the erosive action of the river. The west bank is low bottom land. This location of the bridge is on the line of the most direct highway between Bismarck and Mandan.

C. DESCRIPTION

General—The main structure proper consists of three 476′-0″ thin truss spans, 476′-0″ center to center of shoes, 481′-0″ center to center of piers. There are four main piers. The total length of approaches to the main structure will be about 1,000 feet. These approaches will be constructed of reinforced concrete.

Details: River or Main Piers—The river piers are intended to be placed by the open dredging method (if necessary the pneumatic caisson method will be substituted), using reinforced concrete caissons. The caissons and shaft of the piers shall be of reinforced concrete of a mixture of one part cement, two of sand and four of broken stone or gravel. The footings will be carried down to solid bearing, approximately ten feet into the hard strata of blue clay that lies about one hundred feet below the surface of the low water. The west pier will be carried on wooden piling. After the hollow pier shells have been satisfactorily sunk, the shell will be filled with a matrix consisting of 1-4-5 mix of rubble concrete. The total depths of piers will run from 100′-0″ to 140′-0″.

Details: Reinforced Concrete Approaches—The reinforced concrete approaches will probably be a standard type of tee beam girder span about 40′-0″, viaduct type of piers.

Loadings—Live load will consist of 4 25-ton trucks. Thirty per cent impact will be added for all floor and all truss members taking direct floor loads, and an impact load equal to 20% of the calculated live load for all other members. Horizontal wind pressure of 30 lbs. per square foot of exposed surface and an additional horizontal load of 100 lbs. per linear foot of span have also been taken care of.

Roadway—The roadway will be approximately 24′-0″ wide, with one sidewalk.

Quantities—

All classes of concrete, approximately	12,900	cubic yards
Reinforcing steel	295	tons
Structure steel	2,332	tons
Castings	90,700	pounds
Rollers	10,800	pounds
Pins	7,000	pounds.
Piling	20,000	lineal feet
Excavation—wet	8,300	cubic yards
dry	600	cubic yards

and other smaller details.

Status—The Government has approved the main pier plans and contract will be let on these piers March 17, 1920. The remainder of the plans (trusses and approaches) are pending approval by the U. S. Bureau of Public Roads and will be let at an early date.

TRIALS AND TRIBULATIONS OF A HIGHWAY CONTRACTOR

By Treadwell Twitchell

(Summary)

I come before you, gentlemen, solely as a layman, admitting that I have no technical knowledge of road building, but I have a great deal of practical experience, having built in the last 35 years over 500 miles of roads in Cass County.

Besides being a contractor I am a very heavy taxpayer, so I can see the good roads question from both view points. I am heartily in favor of the good roads plans being carried out under the supervision of the State Highway Commission, for it is necessary that we have some central authority to control the work in the state and see that the construction is economical and efficient.

I am also in favor of local good roads associations to represent the local interests and co-operate with the State Highway Commission, for the people who foot the bills should have at least a little to say concerning the manner in which their money is to be spent.

To get back to the practical side, however, I believe that the engineers of the state have many set ideas that they can't get away from which work against the best interests of their profession. As an example of this I want to sell you about two roads that I bid on recently. These roads are near together and the conditions surrounding each one are practically the same as regards topography and yardage. W. B. Stevenson drew the plans for one of the roads located in Cass County, and the road, completed, cost about $700 per mile. The other road, designed by the engineers of the State Highway Commission, on three borders of the same county and under the same conditions, cost about $3,500 per mile. In the one case there was no regular grade line and the road followed the undulations of the country. The other road follows a regular grade line. The one road was built entirely by machines while the other had to be built by horses. When completed they were of the same value. Is the difference in cost worth the benefits received?

In my experience I have found that you should cut and fill just as little as possible in this country. Heavy cuts and fills may be all right further south, but they are decidedly impractical here. The cuts gather snow and make the roads impassable in winter. Of course, sometimes cuts and fills are necessary where the grade without them would be prohibitive.

I think the plans of the Highway Commission in this respect are wrong. I suppose some fellow in Washington, who never saw this country, drew up the plans and specifications. I would rather trust any of you, although you may be inexperienced in this special line of work, than some fellow in Washington who does not know where North Dakota is. Too many little details are found that cost much and are worth little. Why should we spend $1.50 a yard to take two inches off one place and spread it on somewhere else?

County engineers get out and spend the county money honestly for good roads and then weeds grow up and before long the roads are as bad as they previously were. We fail to recognize that lack of maintenance soon costs us as much as the first cost of the road. We need better road laws to force the localities to maintain the roads.

It is very pleasant to drive along a country road bordered by trees, but these same trees are one of the greatest enemies that good roads have in this country. In the winter they catch the snow, and in the summer, after a rain, they prevent the road from drying out.

I have only words of praise for the bridges built by the State Highway Commission; but what in h—— they want with two sidewalks across the Missouri River bridge at Bismarck I do not know. The pedestrian traffic across that bridge will never be heavier than the pedestrian traffic between Grand Forks and Grafton. Of course, some guy from Bismarck might want to go out and jump off some day, but even that requires only one sidewalk.

A government man in Fargo says that the government is ready to but in a 16-foot slab of 6-inch concrete from the Red River to Barnes County at a cost of a million, three hundred thousand dollars. This would require that Cass County levy the maximum tax for five years and then there would be nothing left for any other roads. The dirt road there at present cost Cass County (with the bridges along its line) $25,000 and it is known as one of the best roads in the United States. Along this road there are only 43 farm houses. How much better it would be to build good roads leading to the present fine highway than try to better this road. I will build every section line in Cass County running to the Red Trail, and there are 43 of them, for the sum which will build this 16 foot concrete road. It is a question of being practical. There are not enough of us to build roads here like they do in the East. We have too much land and too few people.

Cement roads are in no sense permanent roads and we find that cement road maintenance is much greater than earth road maintenance. Why can't we leave our fine material roads alone? From Bismarck north for 150 days in the summer there was one of the finest roads in the world. It was just like asphalt but yet they are tearing it up to build it over.

In the way of maintenance, we should drag roads just before it freezes up each fall, and then we will have a hard top road donated by the Lord Himself. The cost of car maintenance over dirt roads is much lower than it is over concrete roads, and the saving there effected by the dirt road will pay for maintenance and replacement. It has been figured that a good dirt road with a fair amount of traffic pays for itself every 90 days in gasoline and tire savings.

I want to make a plea for the use of common sense in road work and the elimination of these little details which cost so much yet add so little to the value of the road.

DISCUSSION

W. B. Stevenson. I might say that the Lord provided me with almost perfect drainage along the whole 26 miles of the road which Mr. Twitchell mentioned and that road should not be compared with the Highway Commission trunk lines.

THE NEW WATER AND SEWER REGULATIONS OF THE STATE BOARD OF HEALTH

By I. W. Mendelsohn

In November, 1919, the State Board of Health adopted new regulations, among which were some pertaining to water and sewer systems in North Dakota. These were approved by the Attorney General and went into effect on January 1, 1920.

While traveling about the state, my attention has been frequently called to the need of supervision over water and sewer system installations and extensions. At one place a well water of great hardness was being used for the city supply whereas a much softer supply was obtainable. The well supply had been chosen by the city council in contradiction to the engineer's advice. Now a treatment plant is being installed to soften the well water. Proper supervision at the very beginning would have meant the use of the soft water supply and saved the outlay for the treatment plant and for past inconveniences due to the use of hard water.

In another case sewers had been laid to tap desert fields in expectation of a growth in population that will not come for twenty-five years, if then. In still another case, water mains and sewer pipe were laid in a town and at the present time no well has been sunk to tap the water supply which it had been planned to use. No water has passed through the mains though they have been in the ground for the past six months.

It is to correct instances such as these and others too numerous to mention that the new water and sewer regulations were passed. The regulations have to deal with the sanitary features of water and sewer system including the quantity and quality of waters to be supplied and the method of sewage disposal.

The procedure under the plans is as follows: When a town, institution or industry catering to over twenty-five persons in the state is planning to install a waterworks or sewer system, or to change or make additions to existing systems, such a town, institution or industry must submit complete plans, specifications, cost data and an engineer's report of the proposed work, all in triplicate, to the Division of Sanitation of the State Board of Health for approval before any construction work is done. The plans concerning a project will generally be examined by the Division of Sanitation within two weeks, depending upon the amount of work on hand and other factors. To facilitate examination it is advisable that all the information requested be submitted at the same time and as soon as turned out by the engineer. Preliminary rejection of plans or suggested changes will generally be taken up with the engineer designing the system. Final approval or rejection will be indicated in a letter on the project as a whole, copies of which will be sent to the engineer and to the mayor or other executive of the city, institution, or industry for which the system or plant or extension is designed.

In the examination of plans and specifications, the State Board of Health does not examine into the structural features of the design, such as thickness of concrete, adequacy of reinforcing, or the efficiency of any of the mechanical equipment or apparatus. The approval of plans and specifications does not include the approval of any of these features.

The State Board of Health reserves the right to withdraw the approval of any water supply or sewerage system at any future time if it is found to be operating unsatisfactorily, and to require that the alterations and additions be made which are necessary to put it in a satisfactory condition.

Water supply plans are examined as to the features of the design which may affect the safety and quality of water for domestic use. The safety of a water supply depends largely upon the construction of the system to prevent the entrance of contamination. Therefore, the final approval of any water supply cannot be given until after its completion and an inspection has been made.

Plans of sewerage systems are examined as to the features of the design which concern the principles of operation of sanitary sewers and sewage treatment plants. The approval of these plans is given upon the supposition that the survey on which the design is based is correct and that the owners have the legal right to dispose of the effluent as provided by the plans.

Similar regulations have been in satisfactory operation in Minnesota, Montana, New Jersey, New York and other states for several years. It is the intention of the State Board of Health to help the engineers of the state while providing for the health of the inhabitants.

Since it is known that the installation of proper waterworks and sewer systems in communities betters the health conditions, the State Board of Health is favoring strongly such projects. Proof of this has already been demonstrated in three separate cases in the past two months, one a waterworks system, another a sewer system and the third both waterworks and sewer systems. The State Public Health Laboratory makes without charge chemical and bacteriological analyses of waters to be used as city supplies, thereby aiding the engineers in arriving at a determination as to the best supply available. The Board of Health, through connections with other State Boards of Health and the United States Public Health Service, is able to obtain complete information on various water supply and sewage disposal problems and stands ready at all times to transmit this information to the engineers of the state without charge.

In these days of great enterprise and achievement, co-operation is the prime essential. In the case of waterworks and sewer systems, which are so vital to the health of the people, the full and hearty co-operation of the Engineers of North Dakota is requested. Mutual benefits will accrue through such co-operation to the engineers and the people of the state in the achievement of more waterworks and sewerage projects and in better sanitary conditions.

The regulations as adopted are being distributed here in their present form, mimeographed. A considerable part of the regulations is taken up with rules for the preparation and submission of plans for water supply and water treatment systems and sewerage systems and sewage treatment works. Under water supply and water treatment systems there are instructions under the following headings:

1. Submission of plans.
2. Information required.
3. a. General plan.
   b. Details of map.
   c. Lettering, lines and symbols.
   d. Elevations.
   e. Detail drawings.
   f. Profiles.
4. a. Treatment works, general plans.
   b. Detail drawings.
5. Drawings, sizes and titles.
6. Engineer's report.
   a. Source of supply.
   b. Map of watershed.
   c. Wells and collecting galleries.
   d. Information concerning treatment plant.
7. Specifications.
8. Extension or modifications of present system.
9. a. Application for approval.
   b. Samples of water to be analyzed.
   c. Approval of plans.

Under sewerage systems and sewage treatment works the regulations are essentially the same with the addition of sections on profiles, grades and water and sewer connections.

DISCUSSION

W. B. STEVENSON. Is it the intention of the State Board of Health to control both the separate and combined systems, or only sanitary sewers? Minnesota requires separate systems for storm and sanitary sewers.

I. W. MENDELSOHN. North Dakota will deal with the problems in the same manner as Minnesota has done. A conference of the two State Boards is to be held in the near future. Two systems are advisable in Minnesota, *i. e.,* storm and sanitary sewers, but in North Dakota the cost of two systems would be so great that that ruling will not be enforced. Storm water sewer control will not be developed by the North Dakota Board.

C. S. GILES. Does the Board of Health require complete plans of the present systems if an extension is to be developed? To make the detailed maps required by the regulations for Grand Forks would require the expenditure of three thousand dollars.

I. W. MENDELSOHN. The Board of Health will not require the expenditure of any such sum for plans of the present systems.

C. S. GILES. It seems to me, after a hurried reading of several sections (for example section L, article 8, on sewers, distance of sewer outlet from shore and depth of water at mean tide at outlet, if outfall discharges into the ocean or large stream) that these regulations are decidedly impractical for North Dakota. I would like to ask if the regulations as printed will be strictly enforced.

I. W. MENDELSOHN. These regulations were gotten up hurriedly in the form distributed. Later copies have been revised and further revision is to take place. These regulations therefore stand as printed except in a few instances. Great similarity is to be found in the Montana and North Dakota regulations as both were in great part copied from the regulations of the State of New Jersey. That explains your reference to "mean tides and outfall in the ocean."

C. S. GILES. I can see no way in which location and number of hydrants can affect sanitation. Just how will these matters affect public health?

I. W. MENDELSOHN. In some states the location and installation has been so poor as to affect the health. If the hydrants are not constructed so that the fitting is tight there is a danger of pollution.

E. R. GRIFFIN. We had a letter from your board which is not clear. It said samples of water should be submitted for examination, as it is necessary to examine the source of water supply before approval could be given. Suppose a city sent in plans for a water supply project and the wells were not yet dug, would the board approve the plans and allow the work of digging the wells to be taken up at the same time as the other construction work?

I. W. MENDELSOHN. If the water found is not satisfactory, another supply must be obtained.

S. F. Crabbe. If a city found after a year's use that the only supply was injurious for drinking but all right for fire protection, would the board approve the plans?

I. W. Mendelsohn. The board would approve the plans if the condition of the water was made plain to the people.

S. F. Crabbe. Am I to understand that the approval of the board rests upon proper publicity of the quality of the water?

I. W. Mendelsohn. In many places in this state and others the people have been duped into building a water supply system when they did not know what they were getting. If the water were safe although too hard for drinking purposes, the installation would be advised if the cost were compatible with the benefits to be derived.

C. S. Giles. On page 8 of your regulations, article 6, under the heading of Map of Watershed, it says: "A small scale map of the watershed showing the roads and the number and character of buildings shall be included in the report." How can such a map be obtained from Grand Forks? It would mean a detailed map of the entire Red Lake River system. What would we charge such an expenditure to?

I. W. Mendelsohn. Such a requirement must be taken with a grain of salt, and would be separately considered by the board.

C. S. Giles. In my training as an engineer I have been taught to follow instructions as given. This requirement is not practical and I say is ridiculous. Something practical should be evolved that can be followed as printed.

W. H. Brown. I have read over the regulations and detected some of the impracticabilities. Would the State Board of Health consider any recommendations by a committee from this society for changing the requirements?

I. W. Mendelsohn. Yes. Such a proposition would be considered. As much data as possible was considered when the regulations were drawn up. Not all parts of the regulations apply to all cases. In the case of Grand Forks we would certainly not require the watershed map. We are concerned only with the sanitary points of this problem.

E. F. Chandler. This is a case where the fields of medical men and engineers overlap. It is questionable just who should assume authority. Can't we get together on this with a board representing both doctors and engineers?

C. S. Giles. I have not meant that any statements which I have made should be offensive. The expenditures which would be necessary in following out the requirements would certainly require an explanation. We can't stand the cost of gathering this general information to educate the Board of Health. It seems to me that the Board of Health should gather the data and present it to the city engineers.

S. F. Crabbe. I would like to suggest that a committee be appointed to confer with the board to draw up new regulations or revise the old ones.

I. W. Mendelsohn. Fine. A committee would be welcome.

IRRIGATION IN NORTH DAKOTA

By E. F. Chandler

Mr. J. M. Hansen of the office of the State Engineer was scheduled to present a report or paper on this subject, but he was unexpectedly prevented from attendance or from taking the time to formulate a report. As for seventeen years I have been devoting considerable attention to that question in North Dakota, and as Mr. Hansen knew that my ideas on it were similar to his own, he has ordered me to act as his substitute in bringing before the society this subject to which he believes that such members of the society as find it practicable for them ought well to devote more attention.

He said (perhaps confidentially) that the engineering profession of this state, taken as a class, well deserve to be thoroughly roasted, with the accompaniment of appropriate epithet and objurgation, for their general lack of interest and neglect to move toward any action in connection with the promotion or increase of irrigation work, for their habitual failure to notice and urge the utilization of the occasional favorable opportunities here for intensified agriculture as dependent on irrigation, with the resultant great increase in quantity and value of crops and their nearly assured certainty. Irrigation farming requires much greater investment of money, more continuous attention, and the application of many times as much labor to the acre than if dry farming methods are used; but when successfully carried out, the element of luck of fortune or ill-fortune with the chance of total failure, is almost entirely eliminated. The gross returns per acre are so many times increased that the return for each day of labor is greater than before, and the value of the land is enormously increased. Except in unusually favorable locations, success in irrigation development—especially when this branch is new in the region or unaccustomed—cannot be expected unless the work rests upon well-founded and carefully considered engineering plans for obtaining and distributing water; hence it is the duty, and the privilege, of the engineers to have their eyes open for such opportunities; but in this state apparently few of us have given such work a second thought. The irrigation man, if successful, goes far above that standard definition of the public benefactor as being "the man who makes two blades of grass grow where one grew before." In fact, he makes ten blades grow where only one, or perhaps not any, grew before. If the engineer be defined as one "who directs the great forces of nature to the use and convenience of man," irrigation design is certainly and appropriately a branch of engineering.

However, before we plead guilty to incriminating charges of heinous and inexcusable neglect of the duties of our profession, it is only fair that I should state a few of the extenuating circumstances, the facts because of which it was natural and to some extent excusable that we should not yet have given very much attention to irrigation possibilities in North Dakota.

To begin with, talk of irrigation has not always been very favorably received in some parts of this state by the land-owners, or more especially by the dealers in land. Such discussion has been frowned upon, lest it convey the idea that North Dakota is a desert, the prospects for the sale of so-called perfectly good agricultural land be thereby injured, and its value lessened.

Secondly, and truly enough, North Dakota is *not* a barren desert, so what is the need of talking irrigation. The rainfall of the wettest years is likely to be more than needed, more even than desired; the average of wet years and drought-stricken years gives a rainfall nearly equal to the requirements of agriculture, perhaps quite equal to the *minimum* requirements. It is reasonable to defend the assertion that we here suffer not worse from the occasional droughts than those in more humid states are injured by excess of rain. But can we candidly say that we always have in North Dakota as much rain as we need? Not if we are truthful.

This state, or at lease the western half of it, comes within the application of the techincal term, "semi-arid." Usually there is a crop, larger or smaller, but, in a majority of the years or nearly half, more rain at the right season would have been extremely valuable. We are, however, by no means in the condition of the arid region, and our region has no resemlance to those of the sort where without irrigation there is *no* crop. So here it is of course debatable whether irrigation is justifiable, even if practicable; without irrigation the crop would not probably be a complete failure and might be as much as desired; even if irriation can make it more certain and increase its amount in ordinary years, how much expenditure for that purpose is advisable, if any?

Third, in North Dakota opportunities for irrigation are much more limited, and are more circumscribed or bounded unexpectedly by natural conditions, than some states. North Dakota was always in a dry district, even before the state constitutional convention adopted the prohibition clause. There is very little water conveniently available for appropriation by the prospective irrigator. Leaving out of account for the moment wells, and rivers entering the state from outside, we may discuss the source of supply which always seems at first thought the most convenient, ready for use with least effort and simplest plans, namely the surface streams and smaller rivers of the locality, rising within the state.

In such case we are disappointed to find that in North Dakota only a very small fraction of the water that falls on the surface of the land as rain or snow ever reaches the streams, thence to run away unused. The average annual precipitation, rain or snow, for this state is, in round numbers, about twenty inches of water at the eastern margin of the state and fifteen at the western margin. Of this amount, again roughly speaking, slightly less than one inch per year reaches the rivers and flows away.

The average total amount of water coming from the atmosphere to the earth's surface in North Dakota and thence running off into the streams, flowing away wasted, is for the *entire state* less than 5,000 cubic feet per second. If by a comprehensive system of reservoirs including every stream it were possible to utilize completely the yearly flow, to store the water until the season when needed for agriculture, to equalize from year to year by reservoirs the varying run-off of the wet and dry years, and if further it were possible everywhere to apply all this to irrigation in such way that every gallon would be used, and not a single drop falling on the state between the Red River valley on the east and the Yellowstone valley on the west should escape, flowing down the river to the sea,—if such elaborate and visionary plans as thus indicated were possible, even thus the water would be sufficient for the irrigation of only about 2,000 square miles or a little more. This is but a small fraction of the area of the state, less than a thirtieth of the whole. But, if such a project were really feasible, the intensive farming thereby resulting and profitable would easily support a prosperous population of not less than two hundred to the square mile thus cultivated; even if the area were a comparatively small fraction of the whole state, it would add a third or even half to the population and the wealth of North Dakota.

This however is entirely Utopian. Each stream and valley between the eastern and western margins of the state has its own perplexing difficulties, some insuperable, some merely augmenting the expense necessary for development. These might be itemized here for each stream if time permitted, but it will suffice to state merely one opinion, namely: There is no reasonable ground for expecting, or for considering profitable or feasible even in the remote future, any irrigation projects that would take water from streams rising in North Dakota which could aggregate in the total as much as a quarter of the above-mentioned area. But even less than this, much less, would be well worth attention and study; the complete and successful irrigation of areas in this state totalling 500 square miles, or 200, or even 100, would add enormously to Dakota's assured and substantial standing.

Water from without the state passes through in a few streams showing very much larger volumes than all which originate in North Dakota. For example, the Red River here at Grand Forks (five-sixths of whose flow comes from Minnesota) carries an average of 2,800 cubic feet per second, which is more than half as much as the total average of all the streams that arise in North Dakota. But the Red River is not in the region where irrigation is desired.

The Little Missouri River brings in about 500 cubic feet per second from Montana, Wyoming and South Dakota, or about a tenth as much as the total arising in all streams within the state. There are unquestionably many good irrigation opportunities, though each is limited in area, on the Little Missouri.

The Yellowstone river, and the Missorui river, which is about two-thirds the volume of the Yellowstone, join as they enter this state from Montana; their combined volume averages between 20,000 and 25,000 cubic feet per second, which is about five times the total of all North Dakota-born streams and streamlets.

The difficulties in the utilization of these various streams for irrigation are usually some one or more of the following:

Great irregularity through different seasons or years in quantity flowing; lack of water except during flood weeks of a wet year (when irrigation is not wanted); lack of possible or suitable locations for storage reservoirs of sufficient magnitude; broken or bad-land topography, making lengthy diversion canal impossible or outrageously expensive; irregular surface of irrigable lands causing prohibitive expense in preparing to apply water; irrigable lands so high above stream that they cannot be reached by a gravity canal; irrigable lands so high above the source that the fuel expense for pumping would be prohibitive; slope of river channel so small that water cannot be diverted by a gravity canal and no safe location existent for a high diversion dam; shallow-well supply, quantity uncertain, liable to exhaustion by heavy pumping, or to failure in dry season; deep well supply, flow too small in comparison with the cost of the well; chemical character injurious to vegetation.

These various objections have not been stated with the intent of discouraging discussion of irrigation development or preventing further investigation, but merely so that we may realize how many possible difficulties there are, and not be unduly disappointed if some project which at first sight appears feasible is on later survey found to be unwise.

Even after we count the difficulties which may perhaps be found examination of the different areas through Dakota must certainly convince one that there are more than a few locations where in the ultimate development of the state, gravity irrigation projects, usually of only a few acres or few hundred acres, will probably be constructed and operated to the satisfaction and profit of all concerned. And there are unquestionably very many advantageous locations for the installation of individual pumping plants, taking water from such streams as the Little Missouri, Missouri, Cannon Ball, and many smaller ones. If the engineers of the state keep this subject before them and do not allow it to slip entirely out of sight and away from attention, the locations where such methods will really be desirable must in due course of time be brought sufficiently into notice so that actual survey and construction and use will be brought to completion.

THE INCREASED COST OF MATERIALS TO PUBLIC UTILITY COMPANIES

By C. A. Thompson

General Superintendent, Red River Power Company, Grand Forks

The abnormal increase in the costs of all materials has created a serious situation for all public utilities. It has resulted in rate increases throughout the country, accompanied by socialistic agitation for public ownership and ill-will toward the utilities.

I will give a few figures showing how the prices of all materials used generally by these companies have jumped during the past five years. The greater part of a utility's expenses is made up in the cost of labor, fuel, oil, metals used in mechanical and electrical machinery, especially copper, steel, iron and lead, lumber, poles and other construction materials in general.

The government rcently issued the following figures showing the the average increase in the cost of materials generally used in construction work. Using the prices of 1913 as a basis, 100%, we find they had increased as follows:

January, 1917	150%
July, 1917	185%
January, 1918	187%
July, 1918	198%
January, 1919	202%
July, 1919	219%
October, 1919	223%

The government considers October, 1919, the month in which the peak was reached, there having been a slight falling off in some lines since then.

Prof. M. E. Cooley, Dean of Engineering, University of Michigan, tabulated a list of materials generally used, showing what $100.00 worth of each item in 1918 would have cost in 1910. His list is this:

Poles, ties, etc.	$41.50
Steel rails	$41.00 to 51.00
Steel beams	51.00
Pig iron	52.00
Cast iron pipe	45.00
Nails	53.00
Galvanized iron	56.00
Copper wire	55.00
Lead	62.00
Oak	61.50
Maple	62.00
Fir	55.00
Yellow pine	48.00

Note that these figures were based on 1918 prices, which were considerably less than those in 1919.

The Milwaukee R. R. and L. Co., appearing before the state commission, showed that using prices of December 1916 as a basis, the average cost of operation materials for the year ending June 30, 1918, had increased 28.6%; for the last six months of 1918, 47.9%, and for the first six months of 1919, 48.7%, with labor in the latter case increased 64.4%. Here again the base price of 1916 is higher than for a normal year.

The price of coal, which constitutes the major item of manufacturing costs, has increased 125%, with another increase in freight rates and in coal at the mine to be effective very soon. Even the 14% increase granted miners in settlement of the recent strike has been added to coal sold utilities, in spite of the fact that it was understood that the operators should absorb it. The utility companies are now protesting this action.

I have tabulated the following figures showing the approximate increase in the cost of materials used in Grand Forks (as of date February, 1920):

	Increase
Coal	125%
Gas oil	80%
Cast iron pipe	225%
Wrought iron pipe	110%
Boiler tubes	150%
Fire brick	100%
Wire	75%
Galvanized sheet metal	123%
Nails	110%
Builders' hardware	90 to 120%
Paints	125%
Structural steel	200%
Cement	30%
Gravel	25%
Building materials	83%
Lumber	130%
Taxes	about 300%

We installed a new cylinder on one of our engines the past summer. It could have been purchased in 1912 for $3,000; but it cost us now a little over $5,000. Similarly a primary condenser for the gas works cost $1,725, and it could have been bought in 1914 for $700. These figures do not include accessories or installation costs.

As in other lines of industry we have had serious difficulty in getting materials at any price. The great demands of the war made it impossible at times to get construction materials, and while we were able to operate our plants, many times the late arrival of repair parts has impaired our ability to maintain efficient operation and good service.

A paper dealing with the increased cost of materials would be incomplete without referring to the present labor situation. This has had considerable to do with increases in many lines. At the beginning of the war we were just beginning to feel the strength of the labor organizations. It is probably true that labor has not received its share of the profits and was entitled to better wages and better living conditions. During the war period labor organizations have been able to grow rapidly and have been in a position to make demands, which, due to the necessity of maintaining our production at high speed, had to be granted. Thus, the government paid unusually high wages to workers in ammunition works, shipyards, and other war work, and were forced to boost the railroad men regularly rather than risk labor trouble. Increases in all other classes of labor naturally followed.

What has been the result of this? While, generally speaking, a raise in wages has been the last spoke in the cycle of higher prices, it also becomes the first spoke in the next cycle so that the worker usually found that the cost of living was always one jump ahead of him, and although labor has received large increases it has continued to become more discontented. Also, led on by radicals, we find laborers taking a far different attitude toward their work, and it seems to be the general idea to get as much pay as possible and do as little work as possible. We find men laying off much more and taking little interest in their work. In the latter days of the war, from the irregularity with which labor reported for work, it was evident that it was needing more time to spend its money.

This condition is felt by all institutions employing labor, and is one of the things that must be changed if this country expects to get its share of the world trade. We find that, while our labor classes, led by socialistic radicals are clamoring, striking and conspiring for a six hour day and other things,—while this disturbing condition is cutting our production and raising the cost of manufacture,—in Europe labor is settling down or being forced to settle down to business again. Especially is this true on the continent. They realize that it is the only way that they can recover from the effects of the war. In Germany we find that they are united for increased production, working twelve hours a day. In Russia the government has seemingly faced about, is requiring all men to work ten hours a day, and will allow no lay-offs except by permission of its agents. I read a few days ago that pianos made in Germany were being sold in England for less than the labor cost to manufacture them in England.

With this condition of production facing us, when Europe is able to get raw materials she will be able to gain back the great foreign trade we now have and which we should keep. This can result in only one thing, that is low prices, hard times and suffering for the laboring classes of this country.

The following figures from a recent telephone rate case serve to illustrate the above condition. Based on 1914 wages and work done, those of the following years are shown:

Year	Average hourly rate	Time to do same work	% Time used	Resultant wage for same work
1914	25.0c	25 minutes	100%	25.0c
1915	27.5c	26 minutes	104%	28.0c
1916	30.0c	28 minutes	112%	33.6c
1917	35.0c	32 minutes	128%	44.8c
1918	42.5c	42 minutes	168%	71.4c
1919	50.0c	49 minutes	196%	98.0c

That is to say, the work done for 25 cents in 1914 would cost 98 cents in 1919.

We read that before the war it took 20,000 men to produce 40,000

Ford cars in a month, and it now requires 35,000 men to turn out 20,000 cars. This particular car has become so familiar to everyone that we would expect to find this ratio changed the other way.

Using 1915 wages as a 100% basis, wages at our local plant have been raised to the following present scale:

Firemen	250%
Electricians	200%
Gas Fitters	200%
Stokers	250%
Day Labor	250%

Therefore we see that it is not only the high wages that are paid but also (more important) the small amount of work being done in the same time that is helping to cause the present condition.

With these figures before us it is easy to see wherein the public utility companies have been hard hit. A public utility deals in a commodity in which competition has no place. Generally it operates under a charter or franchise from a municipality granting it certain privileges and rights for which, in return, it must render a certain service at certain rates. While other manufacturers and business firms are able to continually adjust their prices to meet changes in costs, such is not the case with the utility. It must get permission from a commission or other governing body and can only do this by showing that existing rates are inadequate. To make this showing it must operate at a loss for a time first, and at the same time may be forced to fight political and other agitation caused by a rate case.

Also these companies have been hard pressed in getting funds to keep up construction work with the demands of increased industrial activity. Money for this purpose is raised by the sale of bonds and securities. This means that it has been necessary to sell several times as much stock to do certain work, and to pay interest on this increased investment for years to come. Operating expenses, which were around 50% of the gross earnings, have increased until they are from 70% to 85% even with increased rates. When we know that the cost of materials and labor have increased at such a rate it is not surprising that we have had an heretofore unknown number of rate adjustments and many receivers appointed as well. It is only fair that a company, which must supply service as required, and to do so must take chances and invest large sums of money, should be able to make a fair return on such investment over and above its operating expenses.

In this brief paper I have attempted to present to you the situation confronting the public utilities for the past few years, which condition we hope will improve as we pass through the readjustment period which is fast approaching.

THE PROPOSED NATIONAL DEPARTMENT OF PUBLIC WORKS

By D. R. Jenkins

(Summary)

Opposing political parties usually say, and perhaps there is a great deal of truth in their words, that men chosen for public office are not chosen for their knowledge and ability to fill those positions, but rather for their political beliefs. This situation does not tend toward economy of operation and even militates against the best interests of the country. It is for the purpose of combating this apparent wasteful and inefficient conduction of our government that the National Public Works Department Association was brought into existence.

The National Public Works Department Association is a league composed of national, state and local societies having an aggregate membership of over 100,000 engineers, architects, constructors, manufacturers, chemists, geologists, economists and business men. Its purpose is to have organized under one department the many and varied public works functions of the federal government. These functions are now scattered through nine separate departments and 39 bureaus and services. It is this independent operation and competitive relation of like functions which in a large degree renders the government so wasteful and inefficient in its business conduct. A private business operated in that way would soon become bankrupt.

By the passage of the Jones-Reavis bill (S. 2232, H. R. 6649) to create a Department of Public Works, under which the major public works functions will be considered and conducted according to the well settled precepts of a modern industrial organization, the league hopes to remedy the present situation.

DISCUSSION

Chandler. This matter has at one time, at least indirectly, affected nearly all those present, for the majority have at one time or another held government positions. We are all well acquainted with the inefficiency resulting from the present method of selecting government officials. Many government officers admit inefficiency and claim that it is entirely due to the existing laws on the subject.

Babcock. Would this affect the educational policies of the nation?

Crabbe. I do not think it would.

Babcock. Educational authorities have gone on record in favor of a Secretary of Education in the cabinet. This plan has proved successful in other countries and is highly championed in this country. It seems to me it would be a big mistake to take this bureau (Bureau of Education) out of the Department of the Interior and throw it into another department no better qualified to act. Otherwise the bill seems very good.

Dove. The only question is where the Department of Education is to be put.

Babcock. It would mean much for Education if it could be a department of the government rather than merely a subdivision of some other department to be shunted from place to place. This may be the logical time, when the old Department of the Interior is being broken up, to put education in a department of itself.

MUNICIPAL IMPROVEMENTS

By C. S. Giles

(Summary)

The speaker discussed one example of a possible municipal improvement, which is now one of the large problems before Grand Forks. At Grand Forks the sliding banks of the Red River cause much damage, by ruining the waterworks intake tunnels, destroying sewer outlets, and moving or distorting the foundations of buildings too near the river bank, along some portions of its course. The ground gradually slides in from each side of the river, a few inches or feet a year, and pushes up in the center of the stream.

The trouble would be at least partially averted by the construction of a low dam across the river below the city. This would increase the water pressure at the foot of the river banks and diminish by that amount the unbalanced pressure of the clay in the banks; as the banks are already nearly at the angle of repose, a slight increase in the back pressure thus caused would undoubtedly diminish the sliding very much and perhaps stop it altogether. There are other advantages, apart from the greater security of the city structures, such as the improved appearance of the river, and its convenience thereafter for canoes and pleasure launches.

The construction of a dam here would require a large expenditure of money, action by both states to authorize it, and a bill in Congress giving permission to close this so-called "navigable" stream. But the advantages apparently to be gained seem to make this well worth while and a very reasonable remedy for the present difficulties. If any member of the society is able to suggest any other solution, however, the speaker asked to receive suggestions.

REPORT ON STANDARDIZED FEES AND PER DIEM FOR ENGINEERING SERVICES

By S. F. Crabbe

Most engineers know what they should get for their services, but in the struggle for business they often cut prices rather than lose the job. I have been unable to find much information relative to this subject. Some bodies have made out elaborate lists of fees and then promptly ignored them. Others have even gone to the extent of signing these lists but still they are not enforced. A license law, it is contended, will fix fees, but present practise does not seem to prove that this method is of any value.

REPORT ON POSSIBLE AFFILIATION WITH A. A. E.

By E. J. Thomas

(Summary of report and discussion)

We have had considerable correspondence with the secretary of the American Association of Engineers, and he advises that we amalgamate with them rather than affiliate with them. The committee of this society to which the consideration of this question was assigned, and for which I am reporting as chairman, recommends that we have a North Dakota Chapter of the A. A. E. There are at present twenty-nine paid up members of the A. A. E. in North Dakota, and I have obtained twenty signatures (that being the minimum number necessary for that purpose) to a petition for a state chapter and have forwarded the petition to the A. A. E. headquarters at Chicago. Among the benefits of such amalgamation would be registration of the engineers of the state, and a definite wage schedule.

The committee offer these resolutions to continue action in this.

(The resolutions as offered were to authorize immediate amalgamation of the North Dakota Society of Engineers with the American Association of Engineers, and provided for the appointment of a committee to arrange the details, embody them in a new constitution and by-laws for the North Dakota Society of Engineers, and to submit the new constitution to the members of the society for final approval by letter ballot.)

W. B. Stevenson. I wonder if it would not be possible to arrange for a combination of the two petitions (Bismarck has also sent in a petition) so that only one chapter will be located in this state. The headquarters should of course be located at Bismarck.

E. J. Thomas. I think that such a course would be possible. In that case half of the entrance fee of $10 would be returned to the state chapter.

E. F. Chandler. I understand that an affirmative vote on the resolutions will commit us to amalgamation.

S. F. Crabbe. I understand the same as Prof. Chandler, this vote will commit us to amalgamation, but we vote later on the by-laws and constitution.

E. J. Babcock. This is an important move and I would not be in favor of going about it so fast. It would put many members out of this society. They should not be forced to join the national association I would rather see the North Dakota Society abolished entirely if it is going to require men to join both the North Dakota Society and the national association.

E. F. Chandler. If the society saw fit, they could join the A. A. E. *en masse.* I have enough data on the North Dakota Society application blanks so that I could fill out the blanks of the A. A. E. for nine-tenths of our members.

K. C. SCHMIDT. Just what would be the benefits of such an amalgamation?

E. J. THOMAS. Some of the benefits which may be derived from amalgamation as proposed are:

1. A definite wage schedule with increase of salaries.
2. Greater publicity for the engineers of the state.
3. New members for the society.
4. Greater prestige and more influence for our society.

E. J. BABCOCK. Could these advantages not be obtained by organizing a chapter of A. A. E. within our North Dakota Society? This movement you sponsor really abolishes the North Dakota Society and makes us a part of the A. A. E. I don't think that a local chapter of the A. A. E., in Fargo for instance, could interfere with us.

E. J. THOMAS. A. A. E. is non-technical and would not interfere with us in any way. I fail to see how we would lose our identity.

E. J. BABCOCK. That is all right, but why should a man have to join the national association before he can join the North Dakota society? We really lose our identity. I believe in affiliation but not by that method.

E. F. CHANDLER. I understood that the North Dakota Society would be allowed to come in as a body.

S. F. CRABBE. This is a technical society and the A. A. E. is non-technical. We cannot lose our identity, so it seems to me that their offers are contradictory.

K. C. SCHMIDT. Must we become a chapter of A. A. E. in order to affiliate? It seems to me if we must become a chapter of A. A. E. we would lose out on our technical discussions here for they would gradually be changed over to a different view point. Our name even is changed to North Dakota Chapter and our interests would be changed to association interests in the same manner.

E. R. GRIFFIN. I do not think that this matter should be brought to a vote with so many of our active members absent.

C. S. GILES. Dean Babcock has pointed out the logical solution. Let those members who desire to join A. A. E. join, and let them form a chapter if they will and still be with us. I will never vote for a resolution which requires a man to belong to the national association before he can belong to the North Dakota Society.

K. C. SCHMIDT. As these resolutions read, every A. A. E. member in North Dakota will belong to the North Dakota Society. We want a higher standard in the North Dakota Society than they maintain in A. A. E. Every draftsman and rodman can get into A. A. E.

S. F. CRABBE. This situation is somewhat like the teachers' union which finally affiliated with the American Federation of Labor. I am in accord with the views presented by C. S. Giles. Our North Dakota Society will not gain from affiliation anything as a body, but only as individuals.

E. White. I would like to amend the resolution to read that all members of the North Dakota Society be given a chance to join the A. A. E. and for all that do so the entrance fee will be waived and that half the annual fees be returned to the North Dakota Society.

E. J. Thomas. I would suggest a committee be appointed and the matter be looked into further and submitted by letter ballot.

S. F. Crabbe. The method suggested would be the proper one to get the opinion of the entire society. There are twenty-five members of A. A. E. who would become members of the North Dakota Society who would not be admitted at present.

E. J. Thomas. I would like to withdraw the resolution and resubmit it with an amendment in which I propose that we amalgamate if satisfactory arrangements can be made. That a new constitution and by-laws then be drawn up and the matter submitted to all members by letter ballot; the understanding being that North Dakota Society men shall not be required to join A. A. E.

E. F. Chandler. Let us pass a resolution saying that we are in favor of amalgamation if it can be arranged to suit us, that is if we can join for $10 per year, half to be remitted and our members not to be required to join A. A. E.

K. C. Schmidt. We cannot suffer through other local chapters of A. A. E. in this state and I fail to see where we benefit by amalgamation.

W. H. Brown. I understand that this vote would take in the entire membership. Arguments could be given pro and con in the letter and the members will then have something on which to base their vote.

E. White. I move that the committee be instructed to draw up new resolutions.

The motion was carried and a recess was taken for informal discussion of the question and to allow the committee more opportunity to rearrange the resolutions.

When again submitted, the resolutions stated as the sense of the session that amalgamation with the American Association of Engineers would be beneficial to the members of the North Dakota Society of Engineers, and provided for the appointment of a committee to arrange details for such affiliation, embody them in a revision of the constitution of the society, and submit the whole matter of affiliation and revision of the constitution of the N. D. S. E., with arguments for and against the change stated in a summarized form, to all the members of the society for a letter ballot. And that if the proposed amalgamation as thus arranged in detail shall receive a three-fourths vote on the letter ballot, it shall become thereby officially approved and adopted.

C. S. Giles. I am very doubtful of the advisability of any such letter-ballot scheme as this, and I submit this motion as a substitute for the entire plan as provided in these resolutions, namely, that this society recommend that any or all members of this society who wish to join the American Association of Engineers do so individually, but that this society keep its organization intact.

E. J. Babcock. My feeling in regard to this is the same, and I second the motion offered by Mr. Giles.

E. White. I think that many of the members of this society endorse the A. A. E. and are in sympathy with its purposes, and that we should seek the assistance of the A. A. E. It seems to me that our purposes are very similar to the purposes of the A. A. E., but we are too small to have much influence ourselves. We ought to obtain the assistance of the A. A. E. if it can be brought about so as not to impair our identity. We should go on with our work as we have, and at the same time co-operate with the A. A. E.

J. A. Wallace. We have approximately seventy-five members, and only twenty-two are present. We ought not to kill this proposition without a vote on it by the entire society.

After further discussion, a vote was taken on the motion (made by C. S. Giles) and it was passed by a vote of 11 to 9. This of course postpones for the present any official amalgamation or affiliation. The discussion following is summarized thus:

E. White. I move that the report of the committee which has just been presented be placed on file and the committee discharged.

R. M. Stee. It looks to me as if the A. A. E. is one big union. In the North Dakota Society we have individuality, and are particular concerning the qualification of new members admitted. We are on a different plane from the A. A. E., and to close an amalgamation might be considered as a step down. I am in favor of the action just now taken by this vote.

E. White. Chapters of the A. A. E. are bound to arise in North Dakota, and it seems to me that we are turning down their assistance and that of the national organization.

J. A. Jardine. What assistance would they give us? In what way, and how much?

E. F. Chandler. Would it not be advantageous to have the committee continued and requested to obtain definite and detailed information in regard to the terms of any acceptable amalgamation or co-operative arrangement with the A. A. E., and report a specific plan at the next meeting of this society?

E. J. Babcock. I have known the history of the North Dakota Society of Engineers from the beginning, and I believe that its organization should be preserved. But the A. A. E. is becoming a strong organization, doing good work, with which we may be able to make advantageous arrangements. I move that the same committee (E. J. Thomas, R. H. Slocum, H. C. Frahm, K. C. Schmidt and G. W. Heinmiller) be reappointed to work out the facts and present them in detail at the next annual meeting of this society.

This motion was carried.

MORNING SESSION, FEBRUARY 10, 1921

(Summary of Addresses)

Opening of session by J. E. Kaulfuss, president of the North Dakota Chapter of the American Association of Engineers.

The presiding officer spoke of the different advantages which it was hoped might result from this joint convention of the North Dakota Society of Engineers and the American Association of Engineers. He stated that there was harmony between the two organizations; that the scope of their work differed in various ways, but that there was no conflict between their general purposes, hence that this joint session would undoubtedly be free from dissension, and would enable the engineers of the state, as a united body, to back any desired movement. He then introduced Mr. C. L. Young, president of the Bismarck Commercial Club, who took the floor with an address of welcome.

C. L. YOUNG. The importance of the work of the engineers and the necessity for their assistance has undoubtedly been recognized from the earliest times, perhaps ever since the building of the pyramids, and now their work is each year more and more in evidence, and their assistance more necessary in the progress of civilization. Here in Bismarck we are continuously seeing new faces of those in the engineering profession, especially those with the State Highway Commission or with the City Engineer. In North Dakota the most important or frequent line of work for engineers is presumably on roads and bridges. The good roads movement deserves all the assistance that can be given. We and you, all of us, ought to boost in that movement.

In Bismarck there has been much engineering work, but I need not speak to you of that, for the City of Bismarck, with its streets and roads, its pavements and every type of municipal improvement, can speak for itself, and you have only to use your eyes to appreciate the work that has been done here. We of Bismarck are all glad to have you present and hope that you will enjoy your stay.

GEORGE LUDVIGSEN. In responding to this welcome in behalf of the American Association of Engineers, of which, because I came from Williston, I am perhaps the most remote member, hence the most in need of assurance that we shall not be turned away from your doors, I need say only that we appreciate the welcome and appreciate it the more because it is expressed as an appreciation of our work, for which we thank you.

E. M. JACK. In behalf of the North Dakota Society of Engineers I can express our gratitude for the cordial welcome which has been given us, and for the inspiration in our work that has been conveyed.

In the early days, as soon as man established a fixed habitation, and property rights in real estate, the engineer of that early period had the duty of fixing the boundaries. From that early time the engineer of each period has been essential in building the temple of civilization. At these meetings we can agree on our standards and secure unity of purpose, and join our forces to the advantage not only of all of our own profession, but of our whole community.

AFTERNOON AND EVENING SESSIONS, FEBRUARY 10, AND MORNING SESSION, FEBRUARY 11, 1921

(Summary of Addresses and Discussions)

E. J. Thomas. Pending legislation of interest to the engineers of the state includes particularly the following bills:

The license law for engineers and surveyors, which was drawn up by a committee of these two societies, and introduced in the House as House Bill 43 by Mr. J. A. Jardine, formerly president of the North Dakota Society of Engineers, now a member of the lower house of the Legislature, is nearly the same as that which has been often recommended before by our society. It is to be hoped that all the members this year will do what they can to secure its passage. Another bill puts the work of the County Engineer on a better footing. There are a number of bills for the extension of the state system of improved highways, which all engineers should endorse most heartily.

J. E. Kaulfuss. The American Association of Engineers has as its chief objects the elevation of the ethical standards of the profession and the promotion of the social and economic condition of engineers. At the present time there are more engineers in this state working for the State Highway Commission than are to be found in any other office or line of work. Therefore, it may fairly be considered that their position is a gauge or measure of the position of other engineers in this region. The committee of the A. A. E. this winter addressed to the Chief Highway Engineer, W. H. Robinson, and to the Budget Board a petition or statement setting forth in detail the lamentably low rates of compensation now paid to the employees of the Highway Commission, and asking that the scale be raised to the proper figures, such as will compare fairly with that of adjoining states. The committee expects also to have an opportunity to appear before the Appropriations Committees of the Senate and the House. The tables which the committee has prepared show a comparison between North Dakota and other states in the salaries paid to the men of the Highway Commission. They are very low in North Dakota. The rates in surrounding states average thirty-six per cent higher than here. Attention ought also to be called to the fact that no direct appropriation from the State Treasury is required for the payment of the forces of the State Highway Commission. The funds for this are taken from the amount received in automobile license fees.

J. N. Roherty. Another very serious inconsistency is found in the present arrangement of the budget. The future amount of work to be done, work that will be called for and become necessary during the next biennial period is unknown, but the work cannot be neglected under penalty of loss of federal assistance. Therefore, it is impossible to fix two years in advance in a budget the exact amount of funds that can properly be expended. The Highway Commission ought to be supported on a percentage basis.

The County Engineer's Law ought to be re-drafted so as to read that the County Commissioners *must* appoint a County Superintendent of Highways, instead of as it at present reads, merely that *they may appoint.* The duties of a County Highway Engineer include all the work of laying out the county system of roads and supervising their construction. His work does not in any way conflict with the work of the State Highway Commission, but is auxiliary to it in just the same way as, after the completion of an ideal system of improved highways through this whole state, the county highways will be the branches or feeders of the main state highways.

W. B. STEVENSON. My own work this year with the committee on legislation was entirely on our proposed law for the registration or license of the engineers and surverors. All the legislators whom we have seen appear favorable to the movement. The City Commission of Fargo asked for a few minor changes in the bill as originally introduced. These amendments did not affect any essential features and since these have been incorporated no further objection is heard.

E. F. CHANDLER. In speaking of this proposed registration law to the legislators the members of our society should remember to keep clearly in mind that this proposal has no political bearing whatsoever. It is not made by, for, or against any political faction in the state, but is for the protection of the public, for the improvement of the work done by engineers, and for the convenience and benefit of future residents of this state, so that they will not suffer as a result of incompetent work.

E. W. ROBINSON. The proposed law fixing the compensation of county officers specifies that the minimum shall not be less than $1,500. No county office now pays more than $3,000. Objection is made by some to the increase in the maximum for county offices on the ground that no county ought ever to pay to its officers more than the state officers are paid. Therefore, the proper thing to bring about is this: That the maximum scale for state officers should be raised to a suitable level, and after that there will be an opportunity to have the maximum raised for the county officers in the larger counties where it is really earned.

W. B. STEVENSON. In many cases under present law it is impossible for the county to secure as officers men of the type really needed. The County Commissioners, for example, under present rates, are likely to find that their per diem and mileage is just about sufficient to pay the actual cost of attendance at meetings of the County Commission, and they are out of pocket by precisely the amount that they need to pay substitutes to take their places in their work at home or in their private business while absent.

J. N. ROHERTY. The deplorable condition in which some of the County Commissioners find themselves for two or three days in the month is the same in which some of the engineers working for the state find themselves through about thirty or thirty-one days in each month. At least we feel that there is very little difference between our situation and beggary.

R. M. Stee. A distinction can properly be made between political officers and the engineering officers. The man who is elected to a political position, especially one which calls for only a few days' work in the month or year, feels that the appointment is an honor, a mark of respect, and indication of the esteem in which he is held by his fellow citizens, and he is not expected to receive any financial return from the position, except enough to save him from serious loss. Or in the case of some other offices, for example that of County Attorney, the holder of the office, because of the publicity thereto which he comes into, receives in the future a very direct benefit in his private business. In the case of the engineer his official work occupies his whole time; he has no private business, and payment merely in respect and honor does not warm or feed him.

Another comparison ought to be made. Long preparation is required for competence to take charge of engineering work; then pay for such position ought therefore to be compared with that of other professions that require a similar amount of preparation, such as the law or medicine. Furthermore, the pay given by the state or county ought to be compared with that paid by private corporations, which is ordinarily very much greater if the man prove competent.

E. W. Robinson. Our name is unfortunate. Ordinarily when mention is made to the man on the street of an engineer he thinks at once of the reliable, energetic, specially trained gentleman who assists him each fall by operating any apparatus which furnishes power for the threshing on his farm.

RATE REGULATION AND REGULATION ENGINEERING

By E. H. Morris

Chief Engineer North Dakota State Railroad Commission

(Summary)

Rate regulation by federal or state government is a matter of recent development, almost entirely since 1876, but it is rapidly becoming universal. Originally, public utilities set the rates entirely according to their own judgment or wish without any supervision by government authority. The people finally were brought to a realization of the fact that the rates, if set by the public utilities and transportation systems, were sometimes entirely arbitrary or discriminated unfairly against the public.

In North Dakota public utility rate regulation is still in an early stage of development. In territorial days in 1885 a State Board of Railroad Commissioners was appointed, but had no power to enforce its orders, and no penalties were provided for violation of its regulations. The Twentieth Territorial Assembly gave the Board of Railroad Commissioners power to prosecute under some special conditions. The State Constitution adopted in 1889 made permanent provision for a Board of Railroad Commissioners, and from time to time the scope of their work has been amplified and their work increased.

The public utilities of North Dakota now under the oversight of the board include the following:

Railroads, eight, with a total mileage of main track and side track in the state of 6,396 miles The historical cost of these was about $160,000,000.

Electric utilities, aggregating about $6,500,000.

Telephone systems valued at $7,108,000.

Waterworks systems, two, under regulation by the commission, valued at $500,000.

Artificial gas systems, five in number, valued at $1,000,000.

Steam heat central plants, thirteen, valued at $1,500,000.

Electric railways, five, valued at $2,000,000.

The total valuation of all these public utilities under the supervision of the State Railroad Commission is about $176,000,000.

Valuation for rate making is no longer merely a question of arithmetic, or percentages of operating cost arbitrarily assumed, but must be passed very definitely on an engineering valuation made by a competent force on the engineering side of the question. It is generally agreed that any public utility is entitled to collect rates which will give to it a net return which will bring a fair rate of interest on a fair valuation of the property. There is, of course, opportunity for debate on the question of what interest rate is a fair rate of return and there may be a large difference in the valuation upon which this rate is allowed, according to the theory upon which this valuation is based.

There are three different theories urged by different parties:

a. The cost of reproduction new.

b. The historical cost.

c. The prudent investment or amount justifiably and prudently invested in the plant.

The first theory, which calls for the cost of reproduction new as the fair valuation to be adopted for rate making, the railroad and public utilities companies are trying to force into adoption. This is the policy to be expected from them, when, as now, the increase in the cost of all materials and labor since actual construction has been so great, for this would increase greatly the valuation upon which they could claim the right to receive suitable dividends.

The second theory calls for a valuation based upon the original cost plus the cost of such improvements as were made to increase the real property in the plant, and not merely to replace wear, minus deductions for diminutions in property, unrepaired wear, and depreciation, or unreplaced losses.

The third theory, that the valuation should be held to include all items of investment which were justifiable, the prudent investment theory, is that which we now urge for approval.

Cost of reproduction would vary absurdly from year to year with rise or fall in the price of materials. Unless the company had on file itemized statements of all parts of the original cost it is impossible to determine with precision the original cost, even though the company opens for inspection all its accounts. It is sometimes argued that if the actual quantities now visible are measured, the value can be based upon the "normal prices" of the materials and included, but all prices are continuously changing so that a normal price for any year, or five-year, period, is a very variable quantity.

All the work of the commission depends on many complicated, interlacing considerations. After a commissioner has been in office for two years and has begun to have a real acquaintance with the essential principles of the work and the methods of their application, he may, perhaps for political reasons, lose his job on the commission, which is a thankless position even at best so that probably he will not regret the loss. To secure real efficiency the commissioners should hold for six years with terms overlapping so that one new appointment would be made in each biennial period, but this requires a constitutional amendment.

J. N. Roherty. Does not the "prudent investment" theory give too much authority to the lawyers or leave too much to the discretion of the legislators; for if rates are so reduced that no return on the investment can be obtained it can no longer be considered a prudent investment, therefore its real value is nothing. Ought valuation not to be chiefly a matter of a physical, involuntary valuation of the actual machinery and property, which engineers are especially qualified to make?

E. H. Morris. True enough, but the "prudent investment" theory leaves less opportunity for interminable discussion as to the actual itemized detail which can no longer be determined from the books or records of the amounts invested. The question whether any actual item of machinery or of equipment was a proper investment, whether it should have been purchased, if the company were using ordinary reasonable foresight, is almost entirely an engineering question and should be left to the engineers to settle.

E. W. Robinson. An important point to consider is that of deterioration or depreciation. In connection with determining the value of earth embankments of which the original volume, or present volume, can actually be determined by measurement, the question of deterioration is sometimes brought up. How ought this to be answered? What is the present value of an earth embankment per cubic yard as compared with its new value?

E. H. Morris. The Interstate Commerce Commission says in effect that on such items no depreciation should be charged. If there is any change in value it is rather appreciation.

MUNICIPAL IMPROVEMENTS THIS YEAR AND THE FUTURE OUTLOOK

By E. R. Griffin

(Summary)

The speaker detailed the many difficulties that have been encountered in carrying through any and every type of municipal improvement during the past year. Engineers, municipalities, and contractors have all had their troubles. The unprecedentedly high cost of labor, the difficulty in securing competent and dependable expert labor in the different trades at the time when wanted, the lack of materials, and the outrageous cost of some materials, and the difficulties and delays in transportation, have combined to make prices so high, and prompt completion so uncertain, that very little work has been done for any of the cities during the past year. There has been little progress in the improvement of our cities, notwithstanding the fact that the population has been continuously growing. There has been hardly any extension of city pavements anywhere in the Northwest. Water main extensions have been very limited and sewer construction equally limited. All the cities have been holding off and waiting for a fall in prices and increased ease in letting contracts.

As a result, in the coming year North Dakota has need for the normal increase in work and extension of municipal improvements, and also for four years extra, the developed improvements of four years when we all were marking time. On account of this delay, the taxpayers are now in a position to be more intelligent in ordering improvements and letting the work than sometimes previously when projects were put under way in unreasonable haste. The contractors who have their experiences and difficulties in the past four years will avoid carelessness and will not plunge, but will use reasonable foresight in undertaking contracts. The engineer will have time to give a well considered careful view to all sides of any proposed improvement.

So the question now is, will prices come down in the coming year enough so that the ordinary city improvements will be permissible? If so when will the lowering occur? There has been a considerable fall already in the wholesale price of most structural materials and a very large decrease in some items, but it now should be looked upon as probable that there will not be any large future decrease, if any, for a long time, and that in some items there will be a slight rise. Hence, there is no advantage in delaying any longer. No reasonable delays will bring lower costs for city improvements, speaking in general terms, than can be secured at present, therefore the municipal engineers and the city officials will do well to get together at once and to make well considered plans for a long time program of a succession of necessary improvements.

After a definite selection of the most urgent needs, which should be put through first if possible, they ought to consider and compare the degree of necessity with the cost, and if sufficiently desirable, ought to let early contracts before the resumption and increase of constructional activity starts prices on an upward trend.

E. J. Thomas. Attention may be called to the sewage disposal plant to be built this year at Minot after long delay. The total cost will be about $275,000, and those of you who are acquainted with present conditions and have seen the plans for the project, all agree concerning its urgent necessity and its unquestioned efficiency to remedy present difficulties.

RULES OF THE STATE BOARD OF HEALTH

By J. N. Roherty
Assistant City Engineer, Bismarck

(Summary)

Two years ago the State Board of Health sent out regulations governing almost all the sanitary engineering work of the engineers of the state, and apparently requiring approval by the State Board of Health of all the details of all the plans for improvement or extension of water main or sewerage systems. Some objections to these regulations arose among the engineers. These resulted partly from a misunderstanding of the wording and partly because the regulations appeared to attempt to dictate concerning matters which in nowise affected public health, for example the regulations were requiring detailed approval of the construction of fire hydrants.

At the March 1920 meeting of the North Dakota Society of Engineers, these questions were discussed by the members with the representatives of the State Board of Health and a committee (C. S. Giles, E. R. Griffin and S. F. Crabbe) was appointed by the society to meet with the representatives of the Board of Health and to arrive at a satisfactory agreement on the details of the regulations. A few weeks later such meetings were held and the regulations were amended so as to be workable and satisfactory to all.

The regulations still seem to ask for a complete map and detailed examination of plans by the state board before any engineer begins construction or lets contract for any work, but really as the rules are enforced, the engineer is assumed to have some common sense so as to know in what cases there might be a question as to the propriety of a project and to be able to do his preliminary work on projects that are unquestionably proper in such a manner that when his plans are submitted they will be approved.

In computing engineering work we must adopt a standard. The rules of the board formulate a very satisfactory standard which we well may follow as closely as possible. The question is asked by some if these rules are not a law, the observance of which is obligatory and a penalty to be inflicted for their disregard. In answer it may be said that observance of the rules is required, but that our own attitude should not be the attitude of trying to dodge or quibble. We have no occasion to attempt evasion, for the rules of the board, as now published, merely state definitely the standard which we ourselves all ought of our own motion to desire to observe.

NATIONAL DEPARTMENT OF PUBLIC WORKS

By E. M. Grime

(Summary)

There have recently been introduced in Congress bills which propose an entire re-arrangement of certain of the departments of government work so as to unite practically all the survey and construction work of the government in a single department; this will be more nearly equivalent to the Department of the Interior than to any other, and therefore, would take the place of the present Department of the Interior. This proposal was embodied in the Jones-Reavis bill, which was introduced by the Senator and Representative whose names are attached, and the McCormick bill later introduced, which embodies nearly the same provisions. At present, almost every one of the departments of the government supervises a larger or smaller portion of the construction or survey work of the government. There is no central, directing head nor any convenient means for securing most economical cooperation between the different branches of such work. The responsibility for recommendation concerning future work of that nature is so much divided that foresight is difficult.

The following list includes the chief bureaus or agencies which will be included in the Department of Public Works, if it takes the place of the present Department of the Interior:

The General Land Office,
The Geological Survey,
The Reclamation Service,
The Bureau of Mines,
The National Park Service.
The Alaskan Engineering Commission,
All other construction work on rivers and harbors and other such improvements, except those directly for the use of the Navy or Army,
The Forest Service,
The Bureau of Standards,
The Coast and Geodetic Survey,
The Bureau of Public Roads.

This movement is not new. For forty years the engineers of the country have been trying to bring about some such arrangement as this in order to prevent working at cross purposes and to bring about efficiency in the work of the government. In April, 1919, a convention of delegates from engineering, architectural and other organizations, representing seventy-four societies and 100,000 members, met at Chicago and organized a federation, which, after some changes of name, has been known as the National Public Works Department Association. For nearly two years this organization has been engaged in the endeavor to bring the advantage of this change into public recognition, and it has now reached the point where nearly all the engineers, or at least the engineering societies of the country, endorse and urge this re-arrangement of the cabinet responsibilities, either precisely as outlined by the Jones-Reavis bill or with approximately the same effect.

The endorsement of this movement now seems so general that the Public Works Association (which was entirely voluntary and without compensation) seems to have fulfilled its purpose, and has, for the present, discontinued activity as an organization. But it is hoped that the engineers of the country will all be interested now to see to it that their Congressional representatives carry through to enactment some one of the bills under consideration.

MINING IN SOUTH AMERICA

By Clarence O. Stee

(Summary)

The speaker had since the close of December returned to the United States from Peru, where he had been for eight years in the force of the Cerro de Pasco Copper Corporation, for which he was superintendent of the Mining Department during the latter part of his engagement. This corporation expends monthly from $150,000 to $200,000 for payroll and other outlay.

Its products are copper and silver. In one exceptional month its output of silver was about 320,000 ounces, and its monthly output of silver and copper combined frequently exceeds that value. The mines in Peru are at an elevation above sea level of about 14,200 feet and are reached by a railroad whose crest elevation above sea level is 15,665 feet.

The speaker detailed many interesting experiences from the time of his residence in the mountains of South America, which were apparently enjoyable despite the disadvantages sometimes resulting from the altitude and other local conditions. Health conditions for those from the United States appear satisfactory if a stay of too many years is not involved, but the altitude makes too long a residence inadvisable for one not acclimated by birth.

About 3,000 men were working under his superintendency. The ordinary pay for miners is less than $1.00 per eight hour day in money of the United States. Sometimes there have been labor troubles, but none that were serious arose in the speaker's division.

THE WORK OF THE STATE HIGHWAY DEPARTMENT

By W. H. Robinson

(Summary)

The State Highway Department was organized in North Dakota in order that this state might be able to meet the requirements of the Federal Highway Act, and share in the federal appropriations for the improvement of highways. The national government offers to pay about half the cost of highway improvement along the main state roads in each state, up to the limit of the allotment assigned to that state, but only upon the provision that the state itself, or its sub-divisions, shall contribute approximately an equal amount and shall have the work done according to the federal regulations. It was therefore the duty of the State Highway Department to arrange the plans and outline the work in accordance with the national requirements, and we had the additional duty of arousing interest through the different counties of the state, so that each country through which a state highway is projected should be willing to contribute its equal share of the expense of construction.

Criticism of the department has sometimes been heard which seemed to have arisen from the fear by those previously in charge of their own localities that the state department was trying to arrange plans so as to supplant them in their own work, but they need have no fear of any such result; the department has not now, and never has had, any such intention. In fact, it is not able, and never has been able, to secure enough men for such unwarranted extension of its work, even if it desired. During the war there was everywhere a lack of competent men for such work. Since the war the funds which have been appropriated for salaries in the department have been too small to keep a sufficient force. Month after month we lose men as they secure positions in other states at increase in compensation, so that the department in this state is perforce a training school for men who work later in other states.

North Dakota's share in the federal fund is about $4,220,000. Up to date the surveys have been completed in this state for 1,430 miles of highway, which is about thirty per cent of the total projected state highway system. The total of the state system of highways is only about seven per cent of the highways of North Dakota. The State Highway Department is not directly concerned with any of the roads or highways of the state, except this seven per cent of the state highways. The most logical final development would include in each county a county system supplementing the state system, and in each township a township system supplementing the county roads. The work so far finished has included the final design of about 1,000 miles. This amount has been finished ready for federal approval, and has necessitated the use of about nineteen miles of blue print paper and the time of one designer and two assistants for six years, which would have rested on the time of seven men for four and one-half years on the survey. About 580 miles of construction have been completed and the projected work for this year includes payments to contractors of about $1,000,000. The total which has already been paid on construction is about $2,000,000. One hundred thirty-five different projects in forty-three counties have been initiated.

After a state system of highways is constructed the Highway Commission will be still responsible for their maintenance. In this we regret to state, our progress has not been as much as one would hope. If is difficult to secure recognition of the necessity of this branch of the work. Apparently the average citizen imagines that when a road is once built and finished, it is done, and will never again require the slightest attention or care. The Commission also has the responsibility for a great amount of war equipment issued to this state for highway work, aggregating in value about one and one-half million dollars. Included in this are 296 trucks which may assist very much in the problem of road maintenance if we are able to put them in order and keep them in shape and assign them to use as needed. Unfortunately, there is no shop available for the repairs to such trucks, and the passage of a bill introduced in the present legislature to provide for such a shop is by no means assured. The trucks are well built and of high grade, most of them have had little use and they are capable of long service after minor repairs, but at present we are forced to store them without shelter on the prairie near Fort Lincoln, where it is expected that you may have a chance to see them tomorrow.

FORESTRY IN NORTH DAKOTA

By F. E. Cobb

Superintendent of the Government Experiment Station at Mandan

(Summary)

North Dakota is not, and presumably never will be, forested to any large extent. The work of forestry will mostly be in promoting the growth of shelter for farm buildings and wood lots. The state may be divided into three areas: The Red River Valley, smooth and even; the Coteau Region, rough, with many sloughs and undrained hollows; the Slope, west of the Missouri River, rough and with perfect drainage. In the Red River Valley the trees are only along the streams in narrow lines or fringes, and around some of the sand dunes and other hills in the Turtle Mountains and Devils Lake region. Along the Missouri River there are some more extensive wooded areas, about the same in total amount perhaps as in the days of Lewis and Clark. In the early steamboat days, many acres were cut along the Missouri River for fuel, but in the latter 70's and early 80's many timber claims were taken, which have again begun to add to the total area of woods. In these it was usually required that five acres of trees should be planted on each claim, and although only a fraction lived to attain satisfactory growth, the total acreage thus added was large.

The 20-inch annual rainfall line runs, roughly speaking, through the middle of the state, down from the Turtle Mountains through Jamestown. East of this, conditions are more favorable for tree growth. Along the Red River and the Sheyenne River there occur naturally many different trees, including, for example, basswood, hackberry, iron wood, hard and soft maple, and red elm. Cottonwood, aspen, burr oak, box elder and others are found scattered over the whole state. In the Little Missouri Valley, the bull pine is often seen. Over the whole state, with the restriction of prairie fires and the disappearance of the buffalo, there is now a greater possibility for the growth of trees than was the case before the advent of settlers.

The Government Experiment Station at Mandan works especially on the culture of grain, fruit and trees. It has been experimenting particularly on methods of tree planting suitable for farms of the state in the form of windbreaks or similarly. Such windbreaks should usually be placed along the north and west sides of a farm or its buildings.

Any farmer may apply to the Experiment Station for the selection of his farm as a location for demonstration tree planting. Sometimes trees are furnished for as much as four or five acres. Upon application instructions are given for preparing the ground the first season. The ground must be summer fallowed or cultivated with a suitable crop, such as corn or potatoes, but must not be put in hay or grain. The farmer is visited, planting plans are arranged, and the next spring the trees are sent to him. In succeeding years a field man is sent to him to advise and notes are taken to cover the methods which have succeeded and the difficulties that have arisen and the suitable means for meeting them. Up to date, 300 plantings have been made, mostly in the western half of the state, and north of Bismarck. Not all of the 300 are now to be seen. Some failed from improper methods in planting, more from lack of attention and allowing the trees to be choked by weeds, but 180 of these demonstration plantings, covering a total of 143 acres, are now flourishing. We expect to be able to extend this work each year, and shall be glad to receive applications from other farmers who are willing to take proper care of the trees. We need especially to ascertain what are the suitable varieties of trees, and methods for their care in land of different character in the different counties of the state.

THE MISSOURI RIVER BRIDGE AT BISMARCK

By C. W. Cubbage

Superintendent Foundation Company, New York

(Summary)

The bridge which is now under construction across the Missouri River between Bismarck and Mandan is a part of the state highway system. All the foundations and piers are built by the Foundation Company, and it is intended that all those at this convention shall have opportunity this afternoon to see the work in progress. The length of the east approach is 470 feet, the west approach is 630, and there are three spans over the river, each being 481 feet in length; total length of bridge about 2,540 feet. Clearance of the bridge above water is 55 feet, which leaves ample room for any possible navigation underneath.

The three channel spans rest on four main piers. The first one at the east bank and the fourth at the west bank are twin piers, each rests on two cylinders. The second and third piers in the middle of the channel are rectangular concrete filled caissons. The depth below low water to which the piers are carried, or will be carried, beginning at the east, are about 41 feet, 46 feet, 84 feet and 73 feet. Twenty thousand linear feet of piling will remain permanently in the work. In the approaches there will be 5,000 cubic yards of concrete and 315 tons of reinforced steel. The excavation necessary to sink the piers amounts to 9,000 cubic yards. The four piers will include 5,800 cubic yards of concrete, 183 tons of reinforcing steel and 86 tons of structural steel.

The details of the methods for sinking the piers have varied according to the foundation material found at each place. Thin layers of coal have been found at some, quicksand at others, boulders and coarse gravel, very leaky, from which it was almost impossible to keep the water pumped out, almost impervious material from which a small pump could easily remove the water. These conditions affected the necessity for using air pressure in the caissons, but for all the piers appropriate modifications of the standard methods for sinking caissons have been entirely successful.

This bridge will be for years a credit to all concerned in the movement for securing it, and to all those employed in its construction. It will convenience very greatly the people of the state, not only those living at Bismarck and Mandan, but any who wish to drive from one side to the other of the Missouri, and it will be an especial benefit in the fall and early spring at times when the ice is forming or breaking up so that the ferries are prevented from running.

FLOOD CONTROL IN NORTH DAKOTA

By E. S. Keene

Chairman of State Flood Control Commission

(Summary)

The portion of North Dakota especially subject to injury from floods is the Red River Valley, where floods, more or less serious in degree, have occurred from time to time since the beginning of history. The extreme within the recollection of the present white settlers is the flood of 1897, which would have been quite impressive in its effect if it had not been so undesirable. In 1882 there was similar misfortune. It is reported that during one of the floods it was even possible to go from Fargo to Cassleton by boat.

The question now before us in the present day of improvement is the usual cause of these floods and any possible methods for their prevention. During a flood period we realize what large figures the damages reach, that injury is wrought to the agricultural land and to some of the towns almost beyond comprehension, and we are ready to go to any possible effort to prevent their recurrence. But during the flood no preventive work is practical, and after the flood is over and it is gone, it is soon forgotten.

The usual cause of the serious floods is something as in 1897, when there was a long cold winter and very heavy snow holding late into the spring, then sudden warm weather and warm rains which carried it into the streams quickly. In 1916 there was a spring flood of the usual character, and then at the end of June very heavy rains caused another flood, the most serious recorded in any summer. This aroused interest very much. The North Dakota Flood Control Association was formed, and then later the Tri-State Flood Control Association. Work in these associations was of course voluntary. Of course, everyone who hears of their purposes immediately sympathizes, but they do very little, and in fact it is a perplexing matter for one to decide what he can do, because of the many complications which affect this.

The area suffering from these floods and the area from which they come is in two states, North Dakota and Minnesota. A case between these states, arising from flood damages which followed extensive drainage ditching, is in the United States Supreme Court at the present moment. It is questionable whether it is legal for either state to do any extensive work in this line without the consent, or the co-operation, of the other state, because both will be injured by, or benefited by, work in either state which will intensify floods or prevent them. Furthermore, the Red River runs into Canada and its floods are certain to make trouble for the Canadians, hence they too are interested and are willing to assist, but the problem becomes thereby a national problem. Furthermore, according to precedent, the Red River is a navigable stream. In the early days chief access to the lower valley was by steamer down the river. Being a navigable stream, the river is in the hands of the War Department.

The question is complicated and must be handled with much nicety. Various perplexing problems come thus before the North Dakota Flood Control Commission, which was organized following its establishment by act of the 1919 legislature, with appropriation of $33,000 to be expended in investigation if necessary. Work of this type is not entirely new. The Miami Conservancy Commission in Ohio of course has been extensively engaged in this line. Minnesota had done more or less work for many years on the drainage question, so that data were available. The United States Department of Agriculture has had parties at work in 1919, and is particularly recommending the utilization of Lake Traverse as a flood control reservoir, but this again is an interstate question, and a remedy not easily obtained except by unanimous consent. The North Dakota Flood Control Commission, therefore, decided that the proper thing to be done in this state the first season was to make such surveys as may be necessary to convince the federal government that we are willing to do our part, and that we approve the general purpose of the movement, so that the federal government ultimately will take hold of this interstate question. We have made surveys of the Sheyenne Valley and of some of the parts of the southwestern Red River Valley, but the final solution of the difficulties must almost necessarily be in the hands of the federal government. The Red River Valley is in part in two states, in fact, three, including a corner of South Dakota, and the whole ought to be a single flood control district. To handle the work for flood prevention in this district, there ought to be an interstate organization which will have an official standing in each state, and each part of which can report back to its own state the joint recommendations for action.

O. E. Blanding

(Harvey, No. Dak.)

President North Dakota Flood Control Association

In the upper valley where my neighbors reside we have little trouble from floods, but on the reverse, we would like to have somewhat more water than sometimes can be found in our region. Flood prevention, or control, by reservoiring in the upper valley, meets our hearty approval. If means can be provided, we should be very glad to conserve and keep near us as long as possible the flood water that the land owners of the lower Red River Valley do not want. The work of the official State Flood Control Commission ought to be finished and brought to a completed whole, ready for delivery to the federal bureaus, arranged as a basis for argument in favor of construction of any advantageous projects, or else the work so far is of comparatively little use.

LIBRARY OF THE SOCIETY

Until the North Dakota Society of Engineers began the issue of its own proceedings, it was not conveniently feasible to begin the collection of a society library. Since the publication of the proceedings was begun, the secretary has endeavored to establish a regular series of exchange with other engineering societies; if attention to this matter is continued, the society will be able to secure a consecutive series of the publications of the similar societies in other states, which discuss present developments in matters of interest to the profession in this state. This will serve as basis for a more extensive general engineering library for the society, and the interest of the members of the society is invited to this, to the end that by their efforts and donations the library may be gradually built up. The following list is a complete catalog of the library up to May 1, 1921.

The State Engineer, Hon. W. H. Robinson, at the request of the society has consented to act as its librarian. Accordingly this library is shelved in the office of the State Engineer in the state capitol at Bismarck where it can be consulted at any time by any member. If any of the members of the society wish to draw any of the books or pamphlets for short times, they can obtain them by mail upon making request of the Librarian if such request is accompanied by the amount of the postage on the book or pamphlet, which will average *six cents* each.

Association of Engineering Societies, Journal of:

Vol. 52, Nos. 1 to 6; Jan. to June, 1914.
Vol. 53, Nos. 2 to 6; Aug. to Dec., 1914.
Each number about 50 pp.

Arkansas Association of Surveyors and Civil Engineers:
Papers at Fifth Annual Meeting, 1913. 22 pp.

Baltimore Engineers Club, Monthly Journal of:

Vol. 4, Nos. 4 to 9; Feb. to July, 1915.
Vol. 5. Nos. 1 to 11; Aug. 1915 to June, 1916.
Vol. 6, Nos. 1, 3 to 5, 7 to 9, 11, 12; July, Sept. to Nov., 1916, Jan. to March, May, June, 1917.
Vol. 7, Nos. 1, 2, 4, 8; July, Aug., Oct., 1917, Feb. 1918.
Each number about 20 pp.

Boston Society of Civil Engineers, Journal of:

Vol. 3, Nos. 1 to 10; Jan. to Dec., 1916.
Vol. 4, Nos. 1 to 10; Jan. to Dec., 1917.
Vol. 5, Nos. 1 to 3, 5 to 8, 10; Jan. to March, May to Oct, Dec., 1918.

Vol. 6, Nos. 1 to 10; Jan. to Dec., 1919.
Vol. 7, Nos. 1 to 10; Jan. to Dec., 1920.

Cleveland Engineering Society, Journal of:
- Vol. 7, Nos. 4 to 6; Jan. to May, 1915.
- Vol. 8, Nos. 1 to 6; July, 1915 to May, 1916.
- Vol. 9, Nos. 1 to 6; July, 1916 to May, 1917.
- Vol. 10, Nos. 1 to 3, 5, 6; July to Dec., 1917, Mar., May, 1918.
- Vol. 11, Nos. 1 to 6; July, 1918 to May, 1919.

Connecticut Society of Civil Engineers:
- Papers and Transactions for 1915 and Proceedings of Thirty-Second Annual Meeting, 1916. 200 pp.

Contracting:
- Vol. 4, Nos. 3 to 11; April to Dec., 1916.
- Vol. 5, Nos. 1, 2, 4 to 8; Jan., Feb., Apr. to Sept., 1917.
- Vol. 8, Nos. 7, 8; April, May, 1919.

Engineering Index:
- Vol. 51, Nos. 2 to 6; May to Sept., 1916.
- Vol. 52, Nos. 1 to 4; Oct., 1916 to Jan., 1917.
- Vol. 53, Nos. 1 to 6; Jan. to June, 1917.
- Vol. 54, Nos. 1 to 6; July to Dec., 1917.
- Vol. 55, Nos. 1 to 6; Jan. to June, 1918.
- Vol. 56, Nos. 1 to 6; July to Dec., 1918.
- Vol. 57, Nos. 1 to 12; Jan. to Dec., 1919.

Florida Engineering Society:
- Year Books, 1919, 1920, 1921. 48 pp. each.

Idaho Society of Engineers, Journal of:
- Vol. 3, No. 11; June, 1913. 150 pp.

Idaho Engineer:
- Vol. 1, Nos. 1 to 3, 5 to 8, 12; May to July, Oct. to Dec., 1916, Jan. and May, 1917.

Illinois Society of Engineers:
- Twenty-Ninth Annual Report, 1914. 150 pp.
- Thirtieth Annual Report, 1915. 150 pp.
- Thirty-First Annual Report, 1916. 180 pp. (Two copies in Library.)
- Thirty-Third Annual Report, 1918. 150 pp.
- Thirty-Fourth Annual Report, 1919. 100 pp.

Indiana Engineering Society:
- Proceedings of Thirty-Fourth Annual Convention, 1914. 370 pp. (Eight copies in Library.)
- Proceedings of Thirty-Fifth Annual Convention, 1915. 350 pp.

Iowa Engineering Society:
- Proceedings, Thirty-First Annual Meeting, 1919. 180 pp.
- Proceedings, Thirty-Second Annual Meeting, 1920. 160 pp.

Kansas Engineering Society, Transactions of:

Vol. 4, 1915. 144 pp. (Three copies in Library.)
Vol. 5, 1916. 110 pp. (Four copies in Library.)
Vol. 6, 1917. 90 pp.
Vol. 7, 1918. 100 pp.
Vol. 8, 1919. 100 pp.

Louisiana Engineering Society, Proceedings of:

Vol. 1, Nos. 2 to 6; Apr. to Dec., 1915.
Vol. 2, Nos. 1 to 6; Feb. to Dec., 1916.
Vol. 3, Nos. 1, 2, 4, 5, 6; Feb., Apr., Aug., Oct., Dec., 1917.
Vol. 4, Nos. 1 to 5; Feb. to Oct., 1918.
Vol. 5, Nos. 1 to 6; Feb. to Dec., 1919.
Vol. 6, Nos. 1 to 6; Feb. to Dec., 1920.
Vol. 7, Nos. 1, 2; Feb., Apr., 1921.

Michigan Engineering Society, Proceedings of:

Vols. 30 to 35; 1909 to 1916.
Vol. 36; Thirty-Eighth Annual Meeting, 1917.
Vol. 37; Thirty-Ninth Annual Meeting, 1918.
Vol. 38; Fortieth Annual Meeting, 1919.
Each number about 200 pp.

Minnesota, Affiliated Engineering Societies of, Bulletin:

Vol. 1, N. S., Nos. 3, 5 to 8; June, Aug. to Nov., 1916.
Vol. 2, N. S., Nos. 2 to 4; Feb. to April, 1917.
Annual Edition, Vol. 1, 1916.

Minnesota Surveyors and Engineers Society, Bulletin:

Vol. 10; 1912 and 1913. 290 pp. (Two copies in Library.)
Vol. 11; 1914 and 1915. 240 pp. (Two copies in Library.)

Montana Institute of Municipal Engineers, Proceeedings:

Vol. 1, 1914. 110 pp.

Ohio Engineering Society, Reports:

Thirty-Fourth to Thirty-Eighth Annual Meetings, 1913 to 1917. (Two copies of each in Library.)
Thirty-Ninth Annual Meeting, 1918. 175 pp.
Fortieth Annual Meeting, 1919. 165 pp.

Oklahoma Society of Engineers, Transactions of:

Vol. 1, 1913. 60 pp.
Vol. 2, 1916. 40 pp.
Vol. 4, 1918. 70 pp.
Vol. 5, 1919. 48 pp.

Ontario Land Surveyors Association, Annual Reports:

Twenty-Second Annual Meeting, 1914. 216 pp.
Twenty-Third Annual Meeting, 1915. 320 pp. (Two copies in Library.)
Twenty-Fourth Annual Meeting, 1916. 385 pp.
Twenty-Fifth Annual Meeting, 1917. 200 pp.

Twenty-Sixth Annual Meeting, 1918. 230 pp.
Twenty-Seventh Annual Meeting, 1919. 190 pp.
Twenty-Eighth Annual Meeting, 1920. 170 pp.
Twenty-Ninth Annual Meeting, 1921. 220 pp.

Oregon Society of Engineers, Journal:
Vol. 1, Nos. 2 to 7; Nov., 1916 to Nov., 1917.

Pennsylvania, Engineers Society of, Journal:
Vol. 7, Nos. 4, 5, 7 to 12; Apr., May, July to Dec., 1915.
Vol. 8, Nos. 1 to 4, 6 to 12; Jan. to Apr., June to Dec., 1916.

Philadelphia, Engineers Club of, Proceedings:
Vol. 32, Nos. 1, 3, 4; Jan., July, Oct., 1915.
Vol. 33, Nos. 1 to 8; Jan. to Dec., 1916.
Vol. 34, Nos. 1, 2, 4, 5, 6, 8, 10, 12; Jan., Feb., Apr. to June, Aug. to Dec., 1917.
Vol. 35, Nos. 1 to 6, 8, 9; Jan. to June, Aug., Sept., 1918.
Vol. 36, Nos. 2 to 5; Feb. to May, 1919.

St. Louis, Engineers Club of:
Twentieth Annual Meeting, 1915. 100 pp.
Year Book, May, 1916. 92 pp.

St. Paul, Civil Engineers Society of, Bulletin:
Vol. 1, Nos. 1 to 5; Nov., 1915 to March, 1916.

Utah Society of Engineers, Monthly Journal:
Vol. 2, No. 1, Jan., 1916.
Vol. 3, Nos. 5 to 12; May to Dec., 1917.
Vol. 4, Nos. 1, 2, 4, 5, 7 to 9, 11, 12; Jan., Feb., Apr., May, July to Sept., Nov., Dec., 1918.
Vol. 5, Nos. 1 to 5, Jan. to July, 1919.

Vermont Society of Engineers, Proceedings of:

March, 1919; Sept., 1919; Oct., 1920. About 40 pp. each.

Western Society of Engineers, Journal of:

Vol. 24, No. 9; Nov., 1919.
Vol. 25, Nos. 2 to 6, 8 to 14; Jan. 20 to Mar. 20, Apr. 20 to Oct., 1920.
Vol. 26, Nos. 1, 3 to 7; Jan., Mar. to July, 1921.

Wisconsin, Engineering Society of:

Eighth Annual Report, 1916. 124 pp.
Ninth Annual Report, 1917. 122 pp.
Tenth Annual Report, 1918. 72 pp.
Eleventh Annual Report, 1919. 104 pp.

STATE DIRECTORY OF MUNICIPAL IMPROVEMENTS

In accordance with vote of the society at previous meetings, which had not before been carried into effect, a committee was appointed this year to compile a short directory of municipal improvements in the towns and cities of North Dakota. At the end of the fall, 1920, this committee sent out a list of questions to each town, and the answers are summarized below. It is the intention that this shall be amended or improved, brought up to date, and omissions corrected, in the next issue of the society proceedings, so that ultimately information on this matter will be readily available for reference by anyone needing it.

Please send notice of any errors, omissions, or extensions to the chairman of the committee, in order that succeeding issues may be correct and complete. A few separate copies of these pages have also been printed, and can be obtained on request from the society secretary, or from the chairman of the committee on Municipal Improvements Directory, R. M. Stee, Valley City.

ALEXANDER—Population, 335. Assessed valuation, $250,000. No bonded debt. Electric lights, 30 amp., 240-110 D. C., municipal ownership; rate 20c kw. Commercial Club. Water supply, large spring piped into village.

AMBROSE—Population, 400. Assessed valuation, $310,000. Bonded debt, $3,500. Water works, cistern, no mains; built by bonds; installed 1915. Source of water supply, flowing well. Electric lights owned by Kately & Huso, Crosby, N. D., curren from there; rate 16c for private. White way, 32 posts. City hall, Commercial club.

ANAMOOSE—Population, 700. Assessed valuation, $440,000. No bonded debt. Water works, 48 blocks, built by special assessment in 1917; rate 75 per M. Source of water supply, well. Sewer system, 36 blocks, installed 1917; sewage disposal, drainage, seepage. Electric lights, 180 kw. capacity, installed in 1915; rate 23c per kw. White way, 24 posts. Commercial club.

BALFOUR—Population, 350. Electric lights, private ownership, installed in 1915; rate 22c per kw. White way, 2 posts. Source of water supply, private wells and cisterns.

BEACH—Population, 1,106. Bonded debt, $22,000. Water works built by bonds and special assessment in 1912; rate 50c to 30c. Source of water supply, wells. Sewer system installed in 1912. Electric lights, private ownership, installed in 1910; rate 22c to 6c. Commercial club.

BEULAH—Population, 552. Assessed valuation, $175,000. Bonded debt, $3,500. Source of water supply, wells. Sewage disposal, carrying. Curb and gutter. Electric lights, 220 kw. capacity, private ownership, installed 1917; rate 20c per kw. City hall.

CANDO—Population, 1,111. Assessed valuation, $300,000. Bonded debt, $2,100. Water works, built by bonds in 1905. Curb and gutter. Electric lights, purchased in 1919. City hall. Source of water supply, 6 drilled wells.

CHURCHS FERRY—Population, 460. Assessed valuation, $353,000. Curb and gutter. Electric lights, built by warrants in 1919; rate 30c.

CRYSTAL—Population, 350. Source of water supply, wells. Electric lights, 110 kw. capacity. City hall

EDGELY—Population, 815. Assessed valuation, $1,000,000. Bonded debt, $18,000. Source of water supply, deep well. Electric lights. City hall.

ELGIN—Water works, 10 block, built by bonds in 1919, source of water supply, pump and tank. Curb and gutter. Electric lights, private ownership, installed in 1914; rate 20c. City hall.

ENDERLIN—Population, 1,200. Assessed valuation, $750,000. Bonded debt, $18,000. Water works, installed in 1913; rate 35c per M. Source of water supply, artesian well and pump from spring. Sewer system, installed in 1913, sewage disposal, septic tank and river drainage. Curb and gutter. Electric lights, private ownership; rate 18c per kw. General heating plant of General Utilities Corporation. City hall. Commercial club.

FARGO—Population, 22,500. Bonded debt, $151,341. Water works installed in 1883; rate 15c. Source of water supply, Red River of the North. Sewer system, sewage disposal, Red River of the North. Paving, about 35 miles. Curb and gutter. Electric lights, private ownership. White way, 370 posts. General heating plant, private ownership; rate 60c per M. Gas plant, rate $2.25 per M. City hall. Commercial club.

FESSENDEN—Population, 800. No bonded debt. Electric lights, private ownership. White way, 20 posts. City hall. Commercial club.

FINGAL—Population, 387. No bonded debt. Electric lights, high tension line. Source of water supply, wells.

FORDVILLE—Population, 432. Assessed valuation, $86,588. No bonded debt. Electric lights, 20 kw. capacity, private ownership; rate 22c per kw. City hall. Source of water supply, wells.

FORMAN—Population, 350. Assessed valuation, $100,000. Bonded debt, $15,000. Curb and gutter, 2 blocks. Electric lights, 25 kw. capacity, private ownership, installed in 1916; rate 25c per kw. first 20 kw., balance at 20c per kw. Source of water supply, artesian wells.

GLEN ULLIN—Bonded debt, $10,500. Water works. Electric lights, private ownership; rate 15c per kw. City hall.

GOLDEN VALLEY—Population, 383. Assessed valuation, $125,000. Bonded debt, $3,500. Electric lights; rate 18c per kw. City hall. Source of water supply, wells.

GRANVILLE—Population, 450. Assessed valuation, $392,000. Bonded debt, $6,500. Source of water supply, wells. Electric lights, private ownership, installed in 1917; rate 18c per kw. City hall. Commercial club.

HALLIDAY—Population, 289. Assessed valuation, $295,650. Bonded debt, $4,500. Source of water supply, wells. Curb and gutter. Paving. Electric lights, 120 kw. capacity, installed in 1915; rate 20c per kw. City hall. Commercial club.

HANSBORO—Population, 218. No bonded debt. Source of water supply, wells. Electric lights, installed in 1916; rate 25c per kw.

HATTON—Population, 832. Assessed valuation, $152,000. Bonded debt, $11,100. Source of water supply, wells, surface water. Curb and gutter, 3 blocks. Electric lights, 60 kw. capacity, built by bonds in 1912; rate 15c per kw. White way, 13 posts. City hall.

HAZEN—Population, 520. Assessed valuation, $400,000. Bonded debt, $3,000. Water works, 24 blocks, installed in 1917, flat rates. Source of water supply, wells. Curb and gutter, 4 blocks. Electric lights, private ownership. White way, 16 posts. City hall. Commercial club.

HEBRON—Population, 1,394. Assessed valuation, $1,600,000. Bonded debt, $12,800. Curb and gutter, 10 blocks. Electric lights, private ownership; rate 12c per kw. White way, 16 posts. City hall. Community club.

HILLSBORO—Population, 1,187. Bonded debt, $21,000. Water works, 65 blocks, installed in 1900; rate 75c per 100 cu. ft., wells. Sewer system, 45 blocks, sewage disposal, dump grounds. Curb, 11 blocks. Electric lights, built by bonds in 1900; rate 17c per kw. City hall. Commercial club.

INKSTER—Population, 400. Assessed valuation, $100,000. No bonded debt. Source of water supply, wells. Electric lights, private ownership; rate 25c per kw. City hall.

KENSAL—Population, 450. No bonded debt. Curb and gutter, 1½ blocks. Electric lights, 110 kw. capacity, private ownership; rate 25c per kw. City hall.

KRAMER—Population, 190. Source of water supply, wells. City hall. Commercial club.

LAMOURE—Population, 1,014. Water works, 33 blocks, installed in 1919; rate 40c per M. Source of water supply, fresh water well, electric driven pump to stand pipe, 6 in. artesian well emergency fire protection. Sewer system, 40 blocks; sewage disposal, into James River. Curb and gutter, 50 blocks. Electric lights, 187½ kw. capacity, owned by Dakota Utilities Co.; rate 22c per kw. City hall. Commercial club.

LANGDON—Population, 1,200. Assessed valuation, $800,000. Water works, 30 blocks, installed in 1918; rate $2.00 per month. Source of water supply, wells. Sewer system, 30 blocks; sewage disposal, into ravine. Curb and gutter, 4 blocks. Electric lights, private ownership. General heating plant, private ownership. City hall. Commercial club.

LARIMORE—Population, 1,400. Assessed valuation, $875,000. Bonded debt, $197,000. Water works, 71 blocks, installed in 1919;

rate, 75c per M. Source of water supply, wells. Sewer system, 67 blocks, installed in 1919; sewage disposal, open prairie. Curbs. Electric lights, 106 kw. capacity, built by special assessments; rate 17c light, 14c power. City hall. Commercial club.

LIGNITE—Population, 220. Curb and gutter. City hall.

LINTON—Population, 1,200. Assessed valuation, $500,000. Bonded debt, none. Source of water supply, wells. Electric lights, private ownership, installed 1920; rate 20c per kw. White way. City hall.

LITCHVILLE—Population, 528. Source of water supply, artesian well. Electric lights, private ownership; rate 15c per kw. City hall.

MCCLUSKY—Population, 650. Assessed valuation, $332,934. Bonded debt, $7,000. Water works, 22 blocks, installed 1912; rate first 4,000 gal., $2.00, balance, 25c per 1,000; minimum monthly charge, $1.00. Source water supply, well 30 ft. deep, 10 ft. across; 50,000 tank on 100 ft. tower; F-M 8 h. p. engine direct connected pump. Electric lights, high tension line from Central Power Co., plant at Washburn, N. D. Commercial club.

MADDOCK—Population, 600. Assessed valuation, $400,000. Bonded debt, $9,000. Source of water supply, wells. Curb and gutter. Electric lights, 35 kw. capacity, built by bonds in 1918; rate 22c per kw. City hall. Commercial club.

MARION—Population, 300. Assessed valuation, $79,000. No bonded debt. Source of water supply, wells. Electric lights, installed in 1916; rate 25c per kw. City hall.

MEDINA—Population, 415. Source of water supply, wells. Electric lights. Curb and gutter. Commercial club.

MOORETON—Population, 150. Assessed valuation, $118,141. Bonded debt, $5,000. Source of water supply, flowing wells. Curb. Electric lights, under construction high line. Commercial club.

MOTT—Population, 800. Assessed valuation, $252,000. No bonded debt. Source of water supply, wells and river. Electric lights, private ownership; rate 20c per kw. City hall. Commercial Club.

NOME—Population, 300. Assessed valuation, $150,000. Bonded debt, $1,800. Water works, artesian well for fire protection only. Electric lights, high tension line from Valley City, installed in 1919; rate 15c per kw.

NORTHWOOD—Population, 969. Assessed valuation, $777,247. Bonded debt, $14,500. Source of water supply, wells. Electric lights, built by bonds and warrants in 1912; rate 12c per kw. White way. City hall. Commercial club.

OAKES—Population, 1,500. Water works, 60 blocks; rate 20c per M. Source of water supply, pumped. Sewer system, 60 blocks; disposal, river. Curb and gutter. Electric lights; rate 18c per kw., General Utilities Co. General heating plant, partly, 10 blocks. City hall. Commercial club.

OSNABROCK—Population, 310. Assessed valuation, $256,000. Bonded debt, $3,000. Source of water supply, wells. Electric lights, installed in 1921; rate 25c per kw. City hall.

ORISKA—Population, 220. Assessed valuation, $279,240. Bonded debt, $3,100. Source of water supply, cistern and pumps. Electric lights; rate 8 and 15c per kw. City hall.

OVERLY—Population, 300. Assessed valuation, $200,000. Electric lights, built by assessment in 1919; rate 28c per kw. City hall.

PEMBINA—Population, 819. Assessed valuation, $251,681. No bonded debt. Electric lights; rate 20c per kw. City hall. Commercial club.

PORTLAND—Population, 615. Bonded debt, $900. Source of water supply, artesian wells. Electric lights, 40 kw. capacity, built by city in 1914; rate, 25c per kw.

REEDER—Population, 380. Assessed valuation, $470,320. No bonded debt. Source of water supply, wells. Curb and gutter. Electric light, 8 private owned plants. City hall. Commercial club.

ROLLA—Population, 700. Assessed valuation, $178,951. Bonded debt, $16,500. Source of water supply, wells. Curb and gutter. Electric lights, 125 kw. capacity, private ownership. City hall. Commercial club.

RUGBY—Population, 1,600. Assessed valuation, $900,000. Bonded debt, $33,000. Water works, 32 blocks, installed 1909. Source of supply, wells; 50,000 gallon tank on 100-ft. tower. Sewer system, 36 blocks; sewage disposal, septic tank. Electric lights, 75 kw. capacity, private ownership, built in 1903; rate 14c per kw. City hall. Commercial club.

ST. JOHN—Population, 500. Water works, 12 blocks, tank. Electric lights, private ownership.

ST. THOMAS—Population, 600. Assessed valuation, $115,000. Bonded debt, $5,000. Source of water supply, wells and cisterns. Curb and gutter. Electric lights. City hall. Commercial club.

SANBORN—Population, 490. Assessed valuation, $117,751. Bonded debt, $8,000. Source of water supply, wells. Curb and gutter. Electric lights, 110 kw. capacity, built by bonds in 1918; rate 16⅓c per kw. City hall. Commercial club.

SARLES—Population, 500. Assessed valuation, $191,000. No bonded debt. Source of water supply, wells. Electric lights, private plants. City hall.

SAWYER—Population, 250. Assessed valuation, $92,000. Bonded debt, $1,000. Source of water supply, wells. Electric lights, private ownership; rate $1.50 to $2.50 flat.

SHARON—Population, 400. Assessed valuation, $250,000. Bonded debt, $4,000. Curb and gutter. Electric lights, built by bonds and special assessment. City hall.

SHERWOOD—Population, 450. Bonded debt, $4,500. Source of water supply, tanked in. Electric lights, private ownership; rate 20c per kw. J

SOURIS—Population, 270. Assessed valuation, $60,457. Bonded debt, $2,000. Source of water supply, wells. Curb and gutter. Electric lights, 2 private installations. Paving, main street and other parts. City hall. Commercial club.

STANLEY—Population, 1,000. Assessed valuation, $1,000,000. Bonded debt, $11,000. Water works, 40 blocks, installed in 1917; rate 75c per M. Source of water supply, 2 wells 200 feet deep. Sewer system, 40 blocks, installed in 1917; disposal, empties into creek. Curb and gutter, 10 blocks. Electric lights, private ownership, installed in 1914; rate 20c per kw. City hall. Commercial club.

STEELE—Population, 550. Assessed valuation, $168,000. No bonded debt. Source of water supply, rainfall and wells. Sewer system, installed about 1890. Electric lights, built by bonds; rate 25c per kw.

STREETER—Population, 640. Source of water supply, wells. Electric lights.

TAYLOR—Population, 285. Source of water supply, wells. Curb and gutter. Electric lights, private ownership, installed in 1915; rate 20c per kw. Commercial club.

TIOGA—Population, 400. Assessed valuation, $340,258. No bonded debt. Electric lights, 16 kw. capacity, installed in 1913; rate 18c per kw. Commercial club.

TOWER CITY—Source of water supply, artesian well. Electric lights, installed 1916; rate 20c per kw. City hall. Commercial club.

TOWNER—Population, 800. Bonded debt, $13,500. Water works built by special assessments in 1908; rate, graduated scale. Source of water supply, underground wells. Curb and gutter. Sewer system, 32 blocks; disposal, river. Electric lights, 32 kw. capacity, private ownership. White way, 24 posts. City hall. Commercial club.

TURTLE LAKE—Population, 450. Assessed valuation, $230,000. Bonded debt, $7,000. Source of water supply, wells. Curb and gutter. Electric lights, private ownership; rate 20c kw. City hall. Commercial club.

VELVA—Water works built by bonds; rate 50c per M. Source of water supply, spring ½ mile from town. Sewer system, built by bonds; disposal, Mouse River. Electric lights; rate 20c kw. Commercial club.

WAHPETON—Population, 3,100. Assessed valuation, $3,000,000. Bonded debt, $65,000. Water works, 120 blocks, installed in 1892; source of water supply, Red River. Sewer system, 120 blocks; disposal, Red River. Curb and gutter, 85 blocks. Paving, 54 blocks. Electric lights, private ownership, installed about 1898. White way, 120 posts. City hall. Commercial club.

WHITE EARTH—Population, 260. Source of water supply, wells. Curb and gutter. Electric lights. built by bonds in 1913; rate 20c per kw. City hall.

WILLISTON—Population, 4,300. Assessed valuation, $2,809,000. Bonded debt, $133,000. Water works, 164 blocks, installed in 1906; source of water supply, Missouri River; rate, 25c per M. Sewer system, 120 blocks; disposal, Missouri River. Curb and gutter. Electric lights, built by bonds in 1906; rate 12½c to 6c. White way, 217 posts. City hall. Commercial club.

RESOLUTIONS PASSED AT THIRTEENTH ANNUAL CONVENTION

The North Dakota Society of Engineers and the North Dakota Chapter of the American Association of Engineers in joint annual session at Bismarck, N. D., on February 10 and 11, 1921, favor

First, further federal aid appropriations to assist the states in the improvement of highways.

Second, the preservation and extension of National Parks.

Third, the creation and preservation of National Parks in North Dakota, most notably in the Bad Lands.

Fourth, the appointment of an engineer of recognized standing to the Interstate Commerce Commission.

Fifth, the adoption of the metric system as the standard of weight, measure, etc., provided the change is made according to some well conceived plan, and

Sixth, the extension of the United States Geological Survey work in North Dakota.

Therefore, be it resolved that copies hereof be sent to President Elect Harding, the senators and representatives of North Dakota in and elected to Congress, the Governor and both houses of the present state legislature.

The North Dakota Society of Engineers and the North Dakota Chapter of the American Association of Engineers in joint annual session at Bismarck, N. D., on February 10 and 11, 1921, hereby declare themselves heartily in favor of the readjustment of work among the departments of the national government in such a way as to centralize for efficiency and economy all federal survey and construction work in a single Department of Public Works, substantially as provided in the recently introduced Jones-Reavis or McCormack bills.

And the secretary of the session is instructed to transmit to each of the senators and representatives of North Dakota a copy of this resolution and urge the favorable consideration of this matter.

The North Dakota Society of Engineers and the North Dakota Chapter of the American Association of Engineers in joint annual session at Bismarck, North Dakota, on February 10 and 11, 1921, favor

First, the enactment of the Professional Engineers' and Surveyors' Registration bill (H. B. No. 43) into law,

Second, the passage of such budgets or other measures as will remove from or insure state departments employing professional engineers and architects from any connection with or influence from politics,

Third, either providing the State Highway Commission with a budget based on an adequate and respectable salary schedule for engineering service, or amending the present laws so that only the Chief Engineer's salary shall be fixed (between $4,500 and $7,500 as may be determined by the commission itself) and so that this department have at its disposal for operating expenses, etc., such elastic funds or flexible reservation based on the work done by or under its supervision as will result in the most effective, efficient, economical and creditable work,

Fourth, the improvement of public service suggesting that the most direct and ready means for doing so and decreasing the wasteful and uneconomical expenditure of public funds is to provide a schedule of pay commensurate with the duties, responsibility, etc., and comparable to the compensation given for similar work in other than public work,

Fifth, the establishment of civil service for state employees,

Sixth, the creation of the office of County Engineer to take the place, duties, etc., of the present county surveyor and superintendent of highways,

Seventh, the adoption of the millage tax plan for educational and other state institutions,

Eighth, a constitutional amendment increasing the compensation and mileage of legislators believing that the change in times and the importance of their work warrants it,

Ninth, adequate appropriations for educational institutions and other state departments, believing that low appropriations and limited budgets are not synonomous with economy and efficiency but are rather the cause of waste and inefficiency.

Therefore be it resolved that copies hereof be made and sent to the secretaries of the two societies, the National Headquarters of the American Association of Engineers, the Governor, and both houses of the present state legislature.

WHEREAS, the State of North Dakota in its development is seriously handicapped by reason of its lack of improved roads, and

WHEREAS, the improved and well maintained roads when secured will inevitably be followed by better schools, better farming, development of resources, growth of population, both on the farms and in the towns and cities, greater prosperity over the entire state, and

WHEREAS, there is now in the hands of the Senate Committee on Highways a concurrent resolution introduced by Senator W. S. Whitman that offers great promise of furnishing the state with a well designed state highway system, properly improved and adequately maintained, that will confer incalculable benefit to each of the counties and to the entire state, Now Therefore

BE IT RESOLVED, that the North Dakota Society of Engineers and the North Dakota Chapter of the American Association of Engineers in joint convention hereby endorse, in substance, the Whitman Concurrent Resolution and respectfully and earnestly request and urge the members of the senate and of the house of representatives now in session assembled to use every honorable effort in favor of the passage of the Whitman Concurrent Resolution.

That this resolution be spread upon the minutes of the North

Dakoat Society of Engineers and upon the minutes of the North Dakota Chapter of the American Association of Engineers and that a copy of the resolution be forwarded to the senate, to the house of representatives, to Senator W. S. Whitman and to Mr. W. E .Holbein, Secretary of the State Good Roads Association.

Be it resolved that the members of the North Dakota Society of Engineers and the North Dakota Chapter of the American Association of Engineers approve of the rules and regulations of the State Board of Health as amended, and that they be adopted as the standard for engineering work in North Dakota on sanitary work, and that the members of these societies extend to the State Board of Health the heartiest cooperation in the bettering of sanitary conditions and enforcing of sanitary measures throughout the state.

Be it resolved by the North Dakota Society of Engineers and the North Dakota Society of Engineers and the North Dakota Chapter of the American Association of Engineers assembled in joint convention at Bismarck, February 10 and 11, 1921, that a vote of thanks be extended to the city of Bismarck for the hospitable reception at this joint convention. That we especially thank the Bismarck Club of the American Association of Engineers for their welcome and entertainment and Mr. W. G. Barneck, chairman of the program committee, for planning a most successful and profitable program. That we express to the City Commission our appreciation as due for the use of the Community Room in the Public Library, to the Librarian for courtesies extended, and to the Commercial Club and the Town Criers for providing transportation to the adjoining points of engineering interest.

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